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The ELECTRICAL REVIEW

FOUNDED 1872

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M.E.M. *See page xi.*

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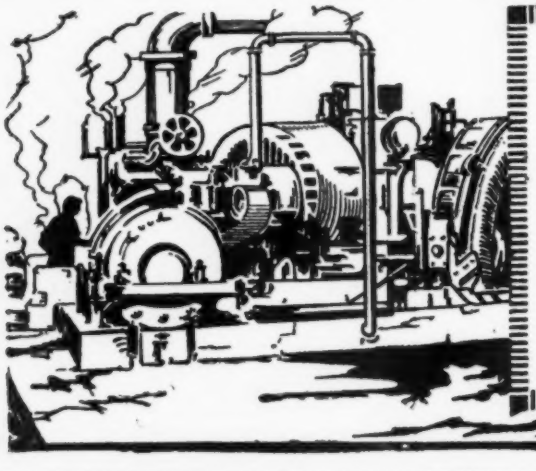

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Electrical Review

Vol. XCV. AUGUST 29, 1924. No. 2,440.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

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OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

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Power from the Tides.

THE decision of the Government to re-open the question whether the Severn barrage scheme is a feasible proposition has brought the subject of tidal power once more into prominence. As we stated in a recent issue, the Treasury has sanctioned the expenditure necessary for the elaborate investigations which must be carried out before any definite verdict can be rendered, including observations of the tides in the Severn; but these cannot be completed in less than at least two years, and therefore, even if the report be favourable, the scheme will have no effect on the unemployment problem for years to come. However, we are glad that the matter has been taken up seriously, and trust that political changes which may take place in the interim will not be allowed to interfere with the progress of the inquiry. The Power Resources Committee of the Board of Trade reported on the scheme four years ago, and recommended the Board, in consultation with the Ministry of Transport, to set up a special technical commission to investigate the subject generally, but with special reference to the Severn, and a year later in its final report the Committee urged that the inquiry should be started as soon as possible; but unfortunately the Government of the day lacked vision and enterprise, and nothing was done. At least the tidal records ought to have been commenced—had that been done, the work of the present commission would have been greatly facilitated.

In France, where the governing authorities are imbued with more practical ideas regarding industry and its needs than most of the politicians who guide our destinies, the subject was broached immediately after the war, and last year the Chamber passed a Bill authorising the creation of an experimental tidal power station in Brittany, on the estuary of Aber Vrac'h, with the aid of State funds. The scheme is taking practical shape, and an account of the technical proposals is given

elsewhere in this issue. The method of compensating for the periods of inaction of the tidal plant, which are inevitable without enormous outlay, is ingenious; whilst the tide is producing energy, the river-water is being stored, so that when the former is idle, the latter can come into operation. The results obtained with this installation, although its maximum output is only 4,800 h.p., will be awaited with keen interest.

It was mentioned in our last issue that the subject of tidal power had been opened in Queensland, where the tides have a very wide range, and there must be many other sites in the Empire which offer favourable conditions for the purpose. At Walton-on-Naze there exists one of the ancient tide-mills that are still to be found in various parts of this country, and a project which was also mentioned in our last issue has been associated with West Mersea, in Essex, at the mouth of the River Blackwater. It is reported that the promoters of the latter have let a contract for the construction of the plant, but according to the local Press nothing has been done on the site; on the other hand, a good deal appears to have been done in the Press and through the post. Highly coloured reports have been published in various parts of the country with regard to the scheme and to the further plans of the promoters, who are alleged to have options on all the suitable sites round the coast; and the *Financial Times*, announcing that subscriptions are being invited for an issue of debentures, points out that there is no evidence that any security exists. Readers will do well to satisfy themselves on this point if they propose to embark on so speculative an investment.

Turning to the technical aspect of the subject, it will be remembered, from our articles on the Severn barrage in 1920, that owing to the varying head of water inherent to tidal power schemes, the turbines must run at varying speed, necessitating the generation of direct current for the sake of independence of frequency. This difficulty may possibly be solved by the introduction of the "Transverter," which is also independent of frequency to a great extent. By using three-phase alternators coupled to the turbines, the generating plant would be simplified and the cost greatly reduced; the three-phase current would then be passed through a Transverter and transmitted as direct current at very high pressure, much more economically than as three-phase current. Whilst this is only one of the problems that beset the subject of tidal power, it presented serious difficulties before the invention of the Transverter, and its solution justifies confidence in the eventual success of tidal-power utilisation.

Another device which has an important bearing on the subject is the Kaplan turbine, which was invented in (what is now) Czecho-Slovakia some twelve years ago, but of which little information was obtainable until recently. This turbine has movable runner blades, and has the advantages over the Francis turbine that it runs at a comparatively high speed with a low head, and that its efficiency remains practically constant under various heads and with varying discharges. According to a short paper read by Dr. Ing. J. Kneidl at the World Power Conference, several turbines of this type have been built for an output of 1,000 b.h.p., with excellent results. In a paper read at the Conference by Dr. Ing. F. Lawaczeck, in which the author comments favourably on the Kaplan turbine, particulars are given of his own improvements in the design of turbines for small heads, and of a method of reducing the cost of the electric generators; the system proposed is to drive centrifugal pumps connected in series, and supplying water at high pressure to an impulse turbine running at high speed. For this system an efficiency of only 64-66 per cent. at the generator shaft is claimed, the cost of the plant, however, being reduced by two-thirds. An experimental installation of this type has been in operation on the Isar River for a year, the effective head of water being 500 ft., whilst the head of water on the turbines is only 10 ft. The author advocates this system especially for rivers with a low head, and for tidal power.

Textile Factory Lighting.

In a textile contemporary the statement was made recently that, for large factories, the economy and illuminating efficiency of high-pressure gas soon repaid the cost of compressing plant, while in smaller factories it was expedient to use gas at ordinary pressure in conjunction with modern superheated cluster lamps or burners. It was contended, further, that where a high-pressure gas supply existed in a neighbourhood, it was desirable to adopt high-pressure lighting even for a small number of lights, as its use entailed no capital expenditure beyond that involved in the purchase and fixing of the lamps and in leading the service pipe from the high-pressure main to the meter. A photograph of a factory workroom was shown, one side of which—apparently in shadow—was lighted electrically, and the other side, brilliant by contrast, was lighted by high-pressure gas.

Inquiries have been addressed, however, to several owners of textile factories as to their opinion of the relative values of high-pressure gas and electric light, and in no case, when both systems of lighting have been tried, have they favoured gas. One large making-up factory in the North of England reverted to electric lighting recently, after a year's experience with high-pressure gas, while another factory is preparing now for next winter with an electric lighting installation. In nearly all these factories there is a certain amount of dust, and it was found that the mantles soon got choked up and destroyed. In addition to a heavy charge for mantles, there was the discomfort caused by the heat from the gas; the latter objection is mainly applicable to dark workrooms—and there are many such—where there is no top light, and where lighting is sometimes necessary on comparatively warm days. Other factory owners who have tried high-pressure gas have found the percentage of accidents increase and the quality of work fall owing to the objectionable glare.

One large clothing factory on the West Coast has retained high-pressure gas for general lighting, but endeavours to minimise the glare defect by fixing the lamps close to the ceiling, every machine and table worker having local lighting. It is common for the local lights all to be in use and only a few of the high-pressure units. The aim of any lighting system is not only to give uniformity of illumination over the working area, but also to place the lights in such a manner as to avoid shadows on the work, and to shade the sources so that the light will not glare in the eyes of the operative. The best local lighting system in a textile making-up factory that we know of is installed in a Lancashire factory. On every worktable there are two standards erected at the ends which support a cross-bar. The cross-bar is channelled on the under side and is adjustable, so that when out of use it is supported on pegs above the worker's head, and when in use it is brought below the level of her eyes. Fitted into the channel on the under side of the cross-bar are cylindrical electric lamps, four or five inches long, the number depending on the length of the table and the number of workers sitting at it.

In the same factory every sewing machine has an electric lamp enclosed in a cylindrical reflector. These lights hang from the ceiling; the wire being enclosed in flexible tubing which enables the operators to move them to the most convenient angle, but, in any useful position, the light rays are diverted from the operative's eyes. In all clothing factories, local lighting at the Hoffmann steam presses constitutes a difficult problem. In the factory just mentioned, the method of attaching a lamp to a belt encircling the operator's chest was tried, but was not successful, and the hanging flexible tube is now used without the cylindrical shield. An alternative method is to support the lamp on a stand. With regard to breakages in this factory, there are over a thousand lights in use, and it is very rarely that a renewal is necessary through breakage. The mantle renewal cost in such a factory with a high-pressure gas installation would be very considerable.

Single-phase from Three-phase.

DURING recent years a number of generating stations have been modernised by the substitution of three-phase turbo-generators for the old high-speed engines driving single-phase alternators, the increased efficiency of modern plant rendering this a very remunerative policy. It would be very desirable, at the same time, to change the system of distribution from single-phase to three-phase, but this is not feasible on account of the heavy expense incurred in relaying mains and replacing services. A method has therefore to be found by which single-phase supply can be given from a three-phase generating system. How best to do this is a matter regarding which there is still much divergence of opinion amongst station engineers. The simplest solution is to split a single-phase system into three at the switchboard, and load one section on each phase. This division of load is very coarse and results in serious unbalancing.

A better plan is to install a bank of 3/2-phase Scott-connected transformers. The single-phase distribution board is divided into two, and one half is connected to each phase on the two-phase side. This method gives a very close balancing of load on the three phases of the three-phase system, and has been adopted for several such schemes, notably at Croydon, proving very successful in practice. The same method also serves where the old system of supply was two-phase.

Again, some authorities have changed their system of supply from two-phase to three-phase. Factory owners are often unwilling to scrap existing two-phase motors, and there, again, 3/2-phase transformers are required. We may mention here that there is a 3/2-phase "auto" connection for transformers; this has not received the attention in this country that its simplicity warrants. It is extensively used abroad and, where the ratio of transformation is suitable, a saving of as much as 75 per cent. may be effected in the cost of the transformer.

The question of single-phase loads for lighting and heating from three-phase networks must also be considered. Where the load is fairly dense, as in towns, the best solution is to install delta-star-connected transformers and divide the loads between the phases. This connection of transformer takes care of any slight out-of-balance on the secondary side. In country districts, where the load is sparsely distributed, this method is not always satisfactory. For single-phase supply alone, single-phase transformers are best. Where small amounts of three-phase power and single-phase lighting are required at the same point, it is better to install a three-phase transformer to deal with the power supply and a single-phase transformer to deal with the lighting and heating.

There are still many engineers who think it possible to obtain a specially wound three-to-single-phase transformer which will not unbalance a three-phase system. Several connections have been evolved for this, but none of them is entirely satisfactory. This particular problem generally arises in connection with single-phase arc welding outfits having an intermittent loading of perhaps 300 amperes, which would be most undesirable when connected across one phase of a three-phase supply transformer. The only satisfactory method of supplying such a load is to install a three-phase motor driving a single-phase generator.

Vibrations of Turbines.

THE repeated breakdowns of large turbines which took place in the United States some years ago forcibly directed attention to the necessity of ascertaining the cause of the trouble, which was traced to a class of vibration to which little importance had previously been attached—namely, axial vibration of the disk wheels, which under certain circumstances might attain sufficient intensity to cause fatigue, leading to a formation of cracks, and eventual disaster. An exhaustive research was undertaken by the General Electric Co. (U.S.A.), of which Mr. Wilfred Campbell was placed in charge in 1919, and a full account of his discoveries and of the methods which he employed is concluded in the August issue of the *General Electric Review*. Unfortunately Mr. Campbell, who was born in Manchester and acquired his technical training at the Municipal School of Technology and with the L. & Y. Railway, died suddenly on July 7th, at the early age of 40. The apparatus which he devised for the study of the phenomenon in question was exceedingly ingenious, and served to reveal beyond doubt the mode of vibration and the fact that the critical speed at which it occurs may readily coincide with the normal running speed. In order to avoid such synchronism, elaborate precautions are now taken at every stage in the design and manufacture of the wheels, and it is satisfactory to record that as the result of these precautions, recently built turbines have been remarkably free from vibrational troubles.

In view of the high speeds of turbines and the enormous stresses involved, it is not surprising that vibration is one of the principal troubles met with in their operation. The fact that violent radial vibration might occur at a critical speed, associated with the dimensions of the shaft, was early recognised, and we hear little of this trouble nowadays. The extraordinary consequences of resonance in the longitudinal bolts through the rotor of an alternator were learnt from its actual occurrence, and the effect of axial vibration has already been referred to. On the whole, it must be considered a remarkable thing, on which the builders are to be congratulated, that the vast majority of turbines have run so well as to establish the reputation of the machine for reliability on a very high plane.

The thanks of designers are due to the General Electric Co. for publishing so full an account of the researches of the late Mr. Campbell and his associates.

The Recovery of Austria.

THE report of Mr. O. S. Phillpotts, O.B.E., Commercial Secretary to the British Legation at Vienna, which is reviewed in this issue, indicates that Austria, thanks to the aid afforded by the League of Nations, is nearing a position of stability so far as the State finances are concerned. Indeed, it is considered in many quarters that the country will be able to dispense with any external aid next year in the establishment of equilibrium between revenue and expenditure. The position apart from the State finances, however, is not so favourable. Although confidence is being restored in commerce and industry by the stabilisation of the currency, there has been a definite reaction from the "boom" which took place early in 1923, and this has been aggravated by "franc" speculation, leading to a number of failures.

Capital is not easy to obtain, and although overtures have been made to British capitalists, most of the proposals have come to nothing. One reason for this, states Mr. Phillpotts, is the reluctance of Austrians to undertake to purchase their requirements from the lending country. As such a course would enable them to obtain money at cheaper rates, it is probable that their attitude will be somewhat relaxed. Water power development and railway electrification were continued during the year with the aid of grants from the League of Nations loans. The commencement of supply from a number of hydro-electric stations during the current year was contingent upon the receipt of sufficient funds for the purpose. It will be seen from this that foreign capital has benefited Austria in two principal directions—stabilisation and development. The latter will be still further advanced if the League of Nations decides to act upon a suggestion that the balance of funds remaining after State finances have been cleared up should be devoted to the assistance of public works and industries.

Great Britain's share in Austria's foreign trade has been small—her interest having been principally financial—but the co-ordination of finance and industry, as intimated in the report, may lead to the placing of a greater number of orders with British manufacturers.

Mica and Micanite Insulation—IV.

By ARCHIBALD A. C. DICKSON.

(*Concluded from page* 278.)

Flexible Micanite.

The size of splittings used for making this class of micanite, so largely used by the electrical industry, is a full-sized No. 5 extra special splitting, but No. 4 of the same quality is also sometimes used (see my third article for sizing of mica and splittings made from mica slab), while the varnish is a copal family spirit varnish, which if properly made should even after drying leave a thin flexible film of the resin as a deposit between the layers of splittings to enable them to be freely bent or be wrapped round a tube of one and a half inches diameter.

The process of building-up the sheets is the same as that adopted in building-up the commutator micanite, but on completion the sheets and oiled base are lifted together and placed on the hot-plate, where the girl keeps turning them about to see that they are not over dried; when one side of the sheet is dried, it is turned over, and the other side is baked in the same way. This is the very best American and Continental practice, recently adopted by a few makers in this country. The popular English practice is to air-dry the sheets, under the mistaken idea that because a so-called air-drying varnish has been used, no baking is necessary, and that the flexibility is greater and more lasting, quite forgetting that the viscidity has to be partly dispelled by evaporation of excess spirits. The test is simple. Let anyone hold a sheet up by the end and see if it holds, or if the splittings slip over one another and the sheet breaks away at the end of the last lot of splittings held in the hands. If insufficiently baked, it will yield in a similar manner. Instead of hanging the sheet by the end, opposite ends can be held and pulled to test for tenacity, which will similarly show all weaknesses in the sheet. In fact, the test, according to the best practice, is carried further; strips of one inch width are cut and wrapped once round a rod and pulled to test for tenacity, as often such strips are used in place of the cloth, silk, and paper backed tapes.

Mica Cloth and Mica Paper.

A piece of leatheroid is placed, as before, as a base, and No. 4 or No. 5 extra special splittings, as used in making flexible micanite, are spread to just cover the entire paper base without leaving any holes or possible outlets for the varnish, which would cause the sheet to stick to the leatheroid and delay or hinder the process. Then the same copal family varnish used above is sprayed or spread over the entire surface. One, two, three or more layers of splittings are spread, according to requirements; when this is done, a sheet of Jap silk tissue paper is placed on top and smoothed out with the brush dipped in the varnish. The whole is then allowed to air-dry, when it is turned upside down on the table and the leatheroid is removed. A piece of cambric, or muslin, is placed on the sheet and dabbed on with varnish and allowed to dry. According to Mr. A. P. M. Fleming, to whom I am indebted for information *re* the Metropolitan-Vickers practice, one layer of large splittings, one of silk Jap paper, and one layer of cambric cloth go to make up the necessary mica cloth from which they cut their tape. Silk tape and paper tape are cut from mica silk and mica paper.

In some rare instances cloth is called for on both sides, but this appears to be more of a Continental practice. In the case of paper in place of cloth and Jap silk tissue paper, proofed paper or sulphite paper is used on both sides.

Mica Folium.

Mica folium, as the name suggests, is just one layer of special 5½ size splittings stuck to paper. The practice for small quantities is to lay a sheet of proofed paper, coat it with shellac varnish, as used for making brown moulding micanite, and then lay over one layer of mica splittings to cover the paper completely without leaving holes, and then coat with a varnish again and dry over hot plates. But it is better to build the folium on whole rolls of paper, slowly passing over a large surface, a partly curved hot plate or table, and at one stage to apply the varnish, a little further on the layer of mica splittings, and still a little further on the finishing layer of varnish; and as this slowly passes over the fourth section of the curved hot plate or table, it completely dries before being taken on to the roller where the finished roll is made. This means unrolling from one roller and treating while unrolling, and rolling the finished mica folium on to another roller, from which it is removed and taken into the stores for stock.

Mica Silk.

The procedure in making this is identical with that detailed with regard to the manufacture of mica cloth, but Jap silk is used on one side in place of the cambric.

Mica and Micanite Tubes.

These are made of No. 4, 5, 5½, and 6 extra special or special splittings according to certain requirements.

Before describing these two forms of tubes, it will be best to explain straightway that a mica tube is made of extra special splittings with a very small percentage of adhesive, and is built with the splittings while rolling, whereas a micanite tube is made of thin sheet brown moulding micanite, if required, of pure micanite, or of mica folium if paper and mica.

(*a*) *Mica Tube.*—A row of splittings are arranged over a piece of Jap silk tissue paper placed on a hot plate, and another piece of paper sufficient to allow three turns round the rod on which the tube is to be rolled is stuck to the end of the row of splittings. The row of splittings is sprinkled over with thin copal family varnish, the three turns of Jap silk paper are wrapped on to the previously oiled rod, and the wrapping is continued to stick a part of the splittings on to the paper on the rod, while more rows are spread and varnish is applied to enable the wrapping to continue without a stop until the desired thickness of tube is completed. Oiled Jap silk paper is wrapped round the top and wired to hold the tube tightly while baking. After baking, the rod is drawn out and again forced through to cut away all the Jap silk paper inside, while the oiled Jap silk paper on top is unwired and removed, leaving the clean silvery-looking finished tube so largely used for high-potential work on the Continent. Another process is to make a paper pattern of the size of the sheet required to wrap the tube and to place a row of mica splittings over it and sprinkle thick shellac varnish over the row of splittings, lay another row of splittings with a three-quarter overlap, and apply another coat of thick shellac varnish, continuing the process until the sheet is covered. The sheet is then placed on a hot plate and brushed all over with thick shellac varnish. When the shellac softens sufficiently and the spirit is evaporating freely, the tube is rolled. The same process of oiling the tube and taking three turns of Jap silk paper before rolling the mica is adhered to, while the finishing inside is the same. These tubes are rolled by hand both for round and square tubes where small quantities are concerned. It is a ready means for urgent work, such as repair work, &c., and

can also be adopted by the control-gear makers and others who use these so largely, but usually in small quantities at a time. Where large quantities of round tubes are concerned, it is better to wrap three turns of the Jap silk paper on the hot oiled mandrel and roll two turns of the softened mica sheet by hand, when the mandrel should be connected to the driving shaft of the tube-rolling machine and pressed against the steam-heated rolls, by which means the necessary pressure is applied, aided by a hand lever, and the wrapping continued until the required diameter of the tube is reached. Stop-gaps are used in this process, too, in the best practice.

(*b*) *Micanite Tubes.*—These are made by laying a sheet of paper the desired size of the sheet and covering it with a layer of thick shellac varnish; then a sheet of the standard thickness thin micanite sheet is stuck on top and shellacked. The micanite covers three-fourths of the pattern of paper sheet and leaves one-fourth for the three-turn preliminary wrapping on to the hot oiled rod. The whole sheet is now placed on a hot plate, and as the shellac softens, the tube is rolled; if by hand, it is rolled as described above, but if by machine, it is done as also described above—but while the paper is being fed into the tube, another layer of thick varnish is applied, and micanite is at the same time fed in. The necessary lengths of paper and micanite are adjusted to give the correct percentage of mica in the tube.

(*c*) *Micafolium Tubes.*—The usual three turns of Jap silk paper are wrapped on the hot oiled mandrel, and the micafolium is then wrapped by hand over a hot plate if small quantities are required; but if large quantities are required, it is rolled by machine as described above. The two turns by hand to ensure a smooth start are usually adopted.

Where square tubes are concerned, it is quite essential to hand-roll thin standard micanite sheets that the corners may be 90 deg. angles and not arched as is so often seen where thick micanite has been used for the job.

On the Continent these tubes are treated in a way to ensure a minimum of varnish, and where paper bound, the ends are usually freed from the paper by leaving a half-inch margin at each end. This is done by cutting away the paper from the edges of the micafolium or micanite tubes. The varnish used is also changed or varied according to the required look or finish of the tube. Some of the Continental so-called "silver mica" tubes are made from ordinary ruby or muscovite mica splittings from India and a copal spirit varnish of special manufacture, which is claimed to be heat-resisting and non-hygroscopic, but as so little varnish is left in the tube, it must resist heat better than the English make, using such large quantities of shellac, as the solid wall of mica formed according to the Continental practice naturally makes it a better heat-resisting tube.

Vee Rings.

Sections are cut out of the standard size thin moulding micanite sheets; small vee-shaped notches are cut in each section or strip to allow free bending and to keep the strips from crinkling; two or three of these are pressed into the hot mould, which is either oiled or lined with loose mica splittings, one over the other, each piece being staggered with respect to the previous piece. They are bent roughly to shape and pressed down, then the whole hot mould, top and bottom, is pressed and removed and placed in a cold screw press, screwed down, and allowed to cool. Very small rings are trimmed by passing a sharp knife round the mould to remove irregular ends or parts, but larger rings are usually trimmed up in a lathe.

For the large vee rings, strips of the standard thin sheet micanite are cut and placed along the mould overlapping or being staggered with respect to each other until the requisite thickness is built up and the mould is completely covered; then the top of the mould is put on and clamped, put into a heated oven, and, after heating, again clamped to tighten while hot, taken out and allowed to cool. The finished vee ring is trimmed up as described.

Channels, troughs, and L-shaped terminals are all made of these special thin standard sheets of micanite, from which strips are cut and pressed home hot one at a time, according to the best practice and to ensure dead-level squares or right angles at the corners of mica. If thicker sheets are used, the right angles are rarely true, and if they are, they are shellac-cornered, and these corners soon wear away. Where large sizes and large quantities of these and other similar shapes are used, a special machine and press, made on the Continent, is used to advantage.

From the foregoing it will be seen that the essential groundwork manufacture that could be done at the mines is the thin sheet micanite, which could be turned out 50 per cent. cheaper than it can be made here, provided always that experienced supervision is available at the mines, and instructions as to manufacture and finish are carried out and adhered to at the mines, which, in their own interests, the miners are bound to do, once they realise that they cannot pass poor varnish or inferior splittings. This will also show that all articles made from these will be proportionately cheaper.

Mica and Micanite Washers.

Mica washers are made by punching the inside hole and the outer edge from sheet mica by means of a compound punch and die at one operation, and when these are required of a specified thickness, they are shellacked and bolted up on a mandrel and baked, then put on a lathe and smoothed; when ready, they are removed from the mandrel and split by means of a special splitting knife.

Micanite washers are, for fairly small diameters, sometimes punched out of sheet micanite at one operation, as above, threaded on a mandrel, varnished and baked, then put on a lathe and turned down to the correct diameter, when they are removed from the mandrel and split to the thickness required.

Large washers, like other shapes, ovals, &c., are usually cut by the band saw and smoothed down by means of emery cloth.

All stamped shapes are stamped by compound dies similarly to the mica washers.

Bushes are made, when moulded, on much the same principle as the vee rings. If cylindrical, they are cut by means of a band saw from standard-size tubes.

It will be seen that there is a great deal in the manufacture and test of mica goods and micanite which I have briefly touched in these articles, and the quicker this is realised and mica brought up to the same standards as other materials used in the electrical industry, either through the medium of the electrical industry in common unison by having a central clearing house, or through the Institution of Electrical Engineers, the quicker will the British electrical industry enter a new era of prosperity far transcending anything it has aspired to heretofore.

Electricity Supply Workers' Wages.—At a meeting of the National Joint Industrial Council for the Electricity Supply Industry a report was presented by the "conciliation committee" appointed at an earlier meeting. This committee, the chairman of which was Mr. W. Addington Willis, of the Ministry of Labour, recommended the appointment of a special tribunal to study the whole question, and to report to the National Council "within a reasonable time"; and that the operation of the notices issued by the Council on July 19th should be suspended until the Council had considered and taken action upon the tribunal's report. The Council adopted the conciliation committee's report, and the tribunal is to be composed of one representative of each of the two parties to the dispute, a member nominated by the president of the Institution of Electrical Engineers, one nominated by organised labour, and a chairman to be appointed by the Minister of Labour. One of the consequences of this decision is that the sliding scale will be temporarily suspended, and the amount of 2s. per week deducted since August 1st will be restored as from the first pay day after August 20th.

Hydro-Electric Power Development in New Zealand.

The Government Mangahao Scheme, North Island.

Among the numerous papers submitted to the World Power Conference was one by Mr. Lawrence Birks, B.Sc., M.I.E.E., chief electrical engineer of the New

Fig. 1.—Mangahao Hydro-electric Station (September, 1923).

Zealand Public Works Department, in which he dealt exhaustively with hydro-electric power development in New Zealand. The total water power available in sources of 1,000 h.p. or more is estimated at 770,000 h.p. for the North Island, and 4,100,000 h.p. for the South Island, so that there is ample justification for the claim that the Dominion is "the Switzerland of the Southern Hemisphere."

In the latter part of 1918 a report on the development of the hydro-electric resources of the North Island, prepared by Mr. E. Parry, B.Sc., M.Inst.C.E., M.I.E.E., then chief electrical engineer to the Public Works Department, was submitted to the N.Z. Government. The scheme outlined therein was adopted as being the one which would develop the water power resources of the island to the fullest extent; it was estimated to cost £7,393,000, but owing to advancing prices an increased outlay has since been authorised.

The scheme provides for the development of three large water power sites in various parts of the island. One of the stations is to be situated on the Mangahao River, one near Lake Waikaremoana, and one on the Waikato River at the Arapuni Rapids. The amount of power that can be obtained from these sources is 24,000 h.p., 40,000 h.p., and 96,000 h.p., respectively. The Waikaremoana site is capable of being further developed to give a total of 130,000 h.p., and that at Arapuni to give 160,000 h.p. The Public Works Department has also recently purchased the Hora Hora plant of 14,000 h.p. capacity from the Waihi Goldmining Co. to supply the South Auckland and Waikato districts. The total output will suffice to serve the whole population of the North Island, the estimate being based on a demand of 1/5 h.p. per head of population, exclusive of any bulk supplies to industrial undertakings that may be commenced.

The Mangahao plant is almost ideally situated for supplying the Wellington area. The Waikaremoana station is favourably situated for supplying the east coast of the North Island, but Arapuni is rather too far south for supplying the northern area. This slight disadvantage of the scheme is, however, compensated for to some extent by the fact that the output from Mangahao is limited, and it will be necessary in the future for Arapuni to augment the supply to the southern part of the island. The arrangements for the transmission and distribution of the power generated at the three stations are very complete. A comprehensive network of main transmission lines linking up the three main stations with one another, and with existing steam and small water-power stations, will cover the whole of the North Island so that no part will be left without a supply of electrical energy. Twenty-nine primary sub-stations are projected for stepping-down the pressure from the transmission voltage; the main lines are being operated at 110,000-115,000 V. Branch lines will be operated at 33,000 volts, except in the neighbourhood of the Hora Hora station where 50,000-volt lines are already in operation, and local distribution will be carried out at 11,000 volts.

The Mangahao Station.

The first of the three main stations to be commenced is that on the Mangahao River. This plant is situated close to a large potential load; in fact, 12,000 kVA of the total output has already been allotted to the Wellington district, and, consequently, it was decided to equip

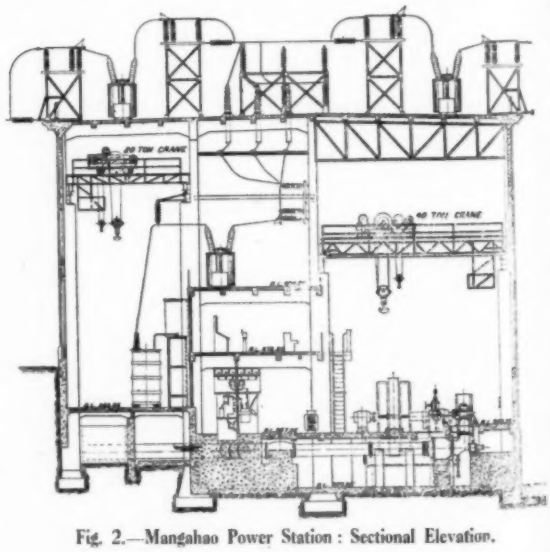


Fig. 2.—Mangahao Power Station: Sectional Elevation.

the station at once with its full complement of plant. Power is mainly obtained by diverting the waters of the Mangahao River through 2¼ miles of tunnels. The scheme provides for two main storage reservoirs, to which a third will be added later; the larger reservoir is situated on the Mangahao River, while the smaller is on the Tokomaru River, close to its junction with the Arapeti stream. The two reservoirs are connected

together by a concrete-lined tunnel, 7 ft. in diameter and about one mile in length, driven through the intervening range of hills. From the second reservoir there is another tunnel, driven through a second range of hills, to the surge tank situated above the power house. The second tunnel is 8 ft. in diameter and about 1½ miles in length. The power station is at the junction of the Mangaore and Mangatangi creeks, the net head of water obtained for driving the water wheels, after allowing a loss of 30 ft. for friction in the pipes, being 870 ft.; but the total fall of water from the projected upper reservoir to the power station will be 995 ft. It is proposed to construct the third reservoir higher up the Mangahao River so that further regulation of the flow of water to the station will be possible; it will also serve to stop any shingle that may be washed down the river in flood times.

The construction of the Mangahao and Arapeti dams proved to be much more difficult than was originally anticipated. The difficulty was due to the trouble in finding a suitable rock foundation and to the frequent floods that have occurred since construction was commenced. Preliminary surveys of the dam sites had failed to reveal that both the Mangahao and Tokomaru rivers had, at some distant period and from some unknown cause, possibly earthquake, cut new beds for themselves parallel to the old ones. This discovery necessitated the construction of a cut-off wall from the end of the dam to the solid rock on the far side of the old channel as a seal to prevent loss of water by seepage round the end of the dam.

When completed the Mangahao Dam No. 1 will be 100 ft. in height, 95 ft. thick at the base, and 118 ft. long. The Mangahao reservoir will hold 525,000,000 gallons of water, and the length of the lake formed will be about 1 mile. The height of the Arapeti dam, which is slightly arched, is the same as that of the Mangahao dam; the length is 430 ft., and the maximum width 66 ft. The amount of water stored, however, is only 290,000,000 gal.

An interesting feature of the plant is the provision of automatic gates for controlling the level of the water at the dam. The crest of the structure where these gates are placed is at an elevation of 1,238 ft. 4½ in., but the water level is held up to an elevation of 1,250 ft. The gates are pivoted about a point slightly below the centre, and the lower portion moves in a chamber in the shape of a quadrant, to which water can be admitted to control the movement of the gates. Narrow siphon spillways are provided, and immediately the water overtops the level of 1,250 ft., the spilling by means of the siphons increases the pressure on the lower half of the pivoted gates, tending to tilt them towards the horizontal, and as long as the level is maintained at 1,250 ft. the main panels will tilt and discharge water over the crest. Should the quantity of water be reduced and the level begin to recede from 1,250 ft., the pressure tilting the gate is reduced by the drying up of the siphon spillways. The gate then tends to return towards the vertical and holds the level up by reducing the discharge.

From the surge chamber at the head of the pipe line the water is taken through two short tunnels to the pipe lines, of which there are two of riveted steel, 6 ft. in diameter. Some distance down the hillside each steel pipe branches into two pipes of smaller diameter, and just outside the power station one of them again divides into two smaller pipes. Water is, therefore, brought into the station by five pipes, three of 36-in. and two of 26-in. diameter. They supply the five Pelton water-wheels that are being installed, and inside the station the five pipes are connected together by a bus pipe, so that no machine may be put out of action by a fault in any one of the pipes.

The station is being equipped with five main generators, each driven by a separate turbine. Three of the generators are of 6,000 kVA and two of 3,000 kVA capacity, a total of 24,000 kVA, the maximum output that can be obtained from this site. Three of the main turbines are designed for a maximum output of 8,000 h.p. and two for 4,000 h.p., the normal outputs being 6,450 and 3,225 h.p., respectively. In both cases the speed is 375 r.p.m. The regulation of the turbines is effected by means of automatic oil-pressure governors which operate directly on deflectors and indirectly upon the needles.

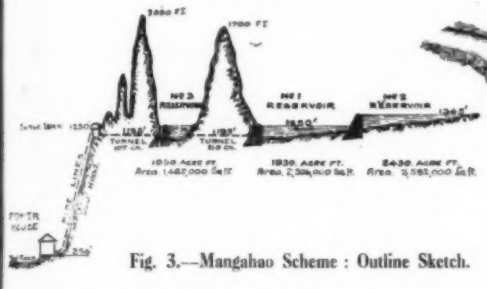


Fig. 3.—Mangahao Scheme : Outline Sketch.

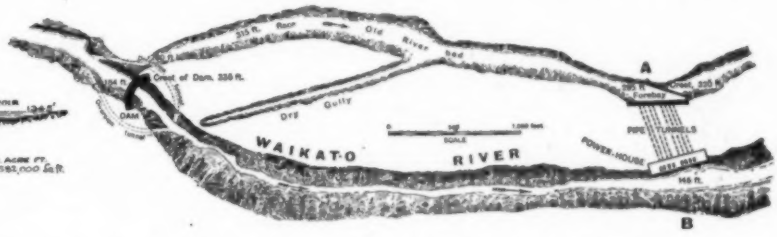


Fig. 4.—Arapuni Scheme : Plan of Existing and Old River Beds and Diversion Dam.

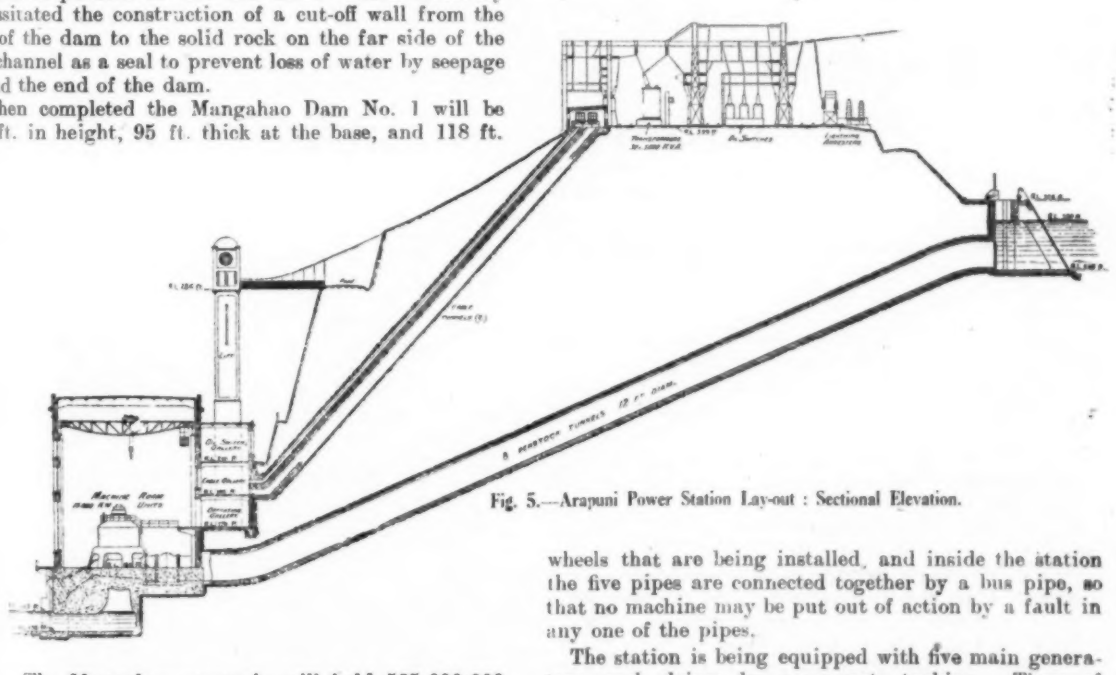


Fig. 5.—Arapuni Power Station Lay-out : Sectional Elevation.

In addition to the main sets two exciters of a maximum output of 470 b.h.p. and a normal output of 375 b.h.p. at 750 r.p.m. are provided. The 3,000-kVA machines are, in addition, fitted with direct-coupled exciters, and the field connections are such that these machines can be excited either from their own exciters or from the main excitation system.

Power is generated at 11,000 volts, 50 periods, and it is distributed at this pressure to the districts immediately surrounding the power station. Station transformers are installed for supplying power at 400 volts to drive the various electrically-operated auxiliaries. The main transmission lines are fed through two banks of three single-phase transformers,* each bank having a capacity of 12,000 kVA; the transformers are connected in delta-star and step-up the pressure from 11,000 to 110,000 volts for transmission purposes. Four high-voltage transmission lines leave the station, two going north to Bunnythorpe, some 25 miles away, and two going south to Khandallah, a distance of 63 miles. The latter sub-station supplies the city of Wellington, while the former supplies Palmerston North and the surrounding Manawatu district. Altogether there will be 300 miles of high-voltage transmission line.

The arrangement of the power station is very compact. The high-voltage switchgear is placed partly inside and partly outside the station. The inside section consists of the circuit breakers and other apparatus necessary for controlling the 11,000-V side of the main transformers and the bus-bar sectionalising arrangement. The outside portion consists of the four outgoing feeder-circuit equipments, together with the lightning arresters. These four sets of equipment are mounted on the station roof, which has been specially designed for the purpose. In order to permit of interchangeability of the high-voltage switchgear all parts are made suitable for inside or outdoor installation.

The transmission lines are run in duplicate on Australian hardwood poles, fitted with suspension-type insulators, and a triangular arrangement of conductors has been adopted. The lines are constructed of 19/13 copper cable spaced at 10-ft. centres. In a 20-mile section, in which the line traverses particularly rough country, double-circuit steel towers are to be substituted for the hard-wood poles, in order to reduce the risk of breakdown and to reduce patrolling work.

It is interesting to put on record the fact that all the plant and apparatus for the Mangahao station, with the exception of the two lightning-arrester equipments, is being supplied by British firms, as is also the equipment for the sub-stations.

* See Elec. Rev., October 20th, 1922.

The Arapuni Station.

Preliminary work in connection with the Arapuni station on the Waikato River, which is mainly intended to supply the city of Auckland at a distance of 104 miles, is well in hand. A feature of this installation is that the water is to be diverted from its present course by a dam 150 ft. high into a former high-level river bed, along which it will flow until a head of 175 ft. can be utilised by returning the water to the river below through penstocks to the power house, which will be located at the bottom of the gorge. The final installation will consist of eight penstocks, each 12 ft. in diameter, and each supplying a single 15,000-kW unit. As a commencement, however, the whole of the headworks and only three of the eight generating sets are being put in hand. The first installation of 45,000 kW is expected to be in operation by 1928, and is estimated to cost £1,770,000, including the transmission lines to Auckland. At first only a single wooden pole line, at 110,000 volts, is to be erected, but ultimately a duplicate steel tower line will be installed. A feature of the scheme is that, while the power house proper will be at the bottom of the gorge, the transformer and distributing station will be located on ground above the level of the penstock intakes, the construction of two cable tunnels to give connection between the two buildings being thus necessary.

Retail Sales Management in the Electrical Trade.

By ERIC N. SIMONS.

There are six fundamentals of successful retail sales management in the electrical trade. These may be enumerated: first comes adequate stock; then follow, in the order given, efficient window and counter displays, fair prices, good organisation, adequate and intelligent salesmanship, and a satisfactory and genuine service. Without going into excessive detail with regard to any one of these six important aspects, each of which could well form the subject of a separate article, it will be as well to take each in turn and give some attention to it from the point of view of its bearing on the general success of the shop.

The keeping of an adequate stock will be found to presuppose not only intelligent buying, but also the provision of enough fixtures to meet the needs of the business. It must not be supposed that the six fundamentals outlined are to be considered as separate matters. All are inter-related. Thus, the quantity of stock kept will depend on the extent of the turnover, which will again largely depend upon the attractiveness of the window display, &c., this itself turning upon the adequacy of the window fixtures.

Prices of such commodities as are not marketed at fixed retail selling prices will be governed by the amount of business attracted, the extent of competition, and the overhead charges. The organisation of the shop involves, among other things, satisfactory stock-keeping methods, effective control of employés, proper methods at the counter, and quick delivery arrangements. Adequate and intelligent salesmanship is a matter of engaging good counter-workers and giving them proper instruction whenever necessary in the special work of selling electrical appliances of all kinds. Finally, satisfactory and genuine service involves the fair and careful handling of complaints, the adjustment of disputes to the satisfaction of the customer, and the giving of instruction in the care and use of the electrical articles purchased. Intimately linked up with all these factors, comes the question of cash payment and the granting of credit.

Having thus briefly run over the essential features of good retail sales management, one may now turn to a consideration of more intricate problems, the failure to solve which often means the ruin of a promising business.

Electrical traders sometimes display complete ignorance as to the exact meaning of profit. Often enough, gross profit is taken to be net profit, especially where no proper book-keeping system exists; or else an essential item in calculating net profit is left out of account. Let us define net profit so as to put the matter beyond all doubt: Net profit is the result obtained after subtracting from the gross takings, over the counter or by remittances from customers, the sums expended in purchasing the goods, in paying wages, and in paying rent, rate, taxes, light and water charges, and whatever other fixed outgoings there may be involved in the upkeep of the shop. This is simple enough, and scarcely deserves exposition, but often misunderstandings arise based on an imperfect grasp of the definition.

Retailers sometimes, for example, fall into the error of imagining that the percentage of the price of goods absorbed by the expense of selling them is an invariable factor. To some extent this obvious mistake is due to the bad practice of reckoning percentages on the price at which commodities are bought, instead of on the price at which they are sold. A little reflection will at once show that the greater the turnover, the greater the profit, if overhead expenses remain relatively unchanged. Or, more simply, if the proportion of gross takings to overhead expenses rises, then profits must rise with it.

There is thus a very close relation between turnover and overhead, to overlook which fact is to engender fear, through underestimation of the profits that can be made by seeking in various ways new customers for electrical goods; through lack of venturesomeness in stocking new devices; and through failure to realise the advantages of advertising and similar methods in reducing overhead. It should be obvious after a perusal of the above paragraphs that the essence of good retail sales management, whether the commodities sold be electrical or otherwise, is *concentration upon the increasing of turnover and the reduction of overhead.* Naturally, if turnover is increased to a certain point, it will become necessary to increase overhead expenses, *e.g.*, by engaging more assistants, extending premises, and so forth. But the thing to bear in mind is the proportion of turnover to overhead, and not the mere figures. For example, if, by opening a showroom, overhead charges are increased 10 per cent. and turnover is increased by 50 per cent., it is obvious that the enterprise has easily paid for itselif and is increasing the net profit.

It will be seen how great a bearing this neglected question of net profit and turnover has upon the six essentials discussed. The best goods to stock are at once perceived to be those that can be turned over most rapidly. The quicker the turnover, bear in mind, the less the capital that needs to be employed. Retailers of electrical goods cannot turn over their stock with the rapidity of, say, a butcher, who turns over his entire stock in a few days; they need, therefore, more capital than the butcher. But the sales-effort of the shop must be concentrated upon the quick-turning goods, whether appliances or materials, rather than upon the slow-turning. The protected profit on electrical goods is seldom less than 25 per cent., and often more, so that every time the retailer invests ten pounds in quick-turning goods, he makes at least £3 6s. 8d. If he can succeed in turning over these goods six times in a year, he has realised a profit of two hundred per cent. per annum on his original investment.

The large profits earned by quick-moving goods should make it clear to the stubbornest retailer that, on the whole, the best electrical goods to stock are those extensively advertised. Proprietary appliances and commodities have tremendous selling-force behind them. People will come into a shop and ask for so and so's electric vacuum cleaner, refusing to be satisfied with any other. The electrical trader who ignores this potent factor in the rapid selling of appliances is setting himself unaided against the enormous influence wielded by proprietary advertisement, and is inviting his own downfall. There are two factors that tempt electrical retailers to sell unadvertised (and often unbranded) goods rather than the better-known varieties. The first is that the proprietary goods can be bought quite as easily in one shop as in another. The second is that unbranded goods often carry a larger profit. But to give way to the temptation represented by these two considerations is bad policy, for reasons to be adduced. The fact that advertised appliances can be bought as easily from Jones as from Brown is really an argument in favour of stocking them. People who want a Smith electric iron and go to Brown for it will soon turn to Jones instead, if Brown makes it difficult for them to get what they want. Folk hate arguing, most of all with a shopkeeper, and the only way in which the small trader can compete with the big general store is by making shopping comfortable and easy for his customers. Try to palm off a cheap German electric iron on to a customer who distinctly asks for a Smith iron, and when that customer next wants a Smith vacuum cleaner he will go where he can get it without being compelled to justify his selection and fight for what he wants.

Some space has been given to this matter because it is important that frequent fallacies of retail sales management should be disproved.

The fact that unadvertised goods sometimes carry a larger immediate profit tempts retailers only because they fail to consider the question of speed of sale. As has been shown, well-advertised commodities turn over very quickly, and therefore the percentage of profit per annum on them is extremely high. Unadvertised and unbranded goods turn over by contrast very slowly, and though the immediate profit may be double that on the advertised appliance, if the stock is only cleared out once in a year, the percentage of profit per annum is much smaller.

An important factor in securing quick turnover is not only effective window and showroom display, but also clever shop-dressing. Thus, many electrical appliances and goods will almost sell themselves if placed somewhere on the counter where the customer can pick them up and examine them. A cleverly-arranged counter can become a perpetual demonstration table. One electrical trader makes considerable profits in this way. He has here and there on a long counter running the full length of his shop the latest electrical appliances, all connected up and in working order. A notice invites customers to switch on the current and see for themselves what the appliances will do. A shaving mug of cold water stands beside a clever little gadget for heating it. Press the switch, pop the "gadget" into the water, and in an amazingly brief space the shaving water is ready. An electric kettle boils in the same way. The point is that the customers demonstrate these things to themselves. Of course, a watchful eye is kept on proceedings, to obviate risk or difficulty, and to ensure the satisfactory working of the "exhibits," but seldom a day passes without one appliance or another being sold to someone who had originally no intention of purchasing it. The appliances are changed frequently, and it is certain that customers remember this man's shop, not only because he carries a well-displayed and adequate stock, but because it is extremely interesting.

Advertised and proprietary goods are almost always sold at fixed prices, and therefore the influence of price on turnover is confined solely to what may be called bulk and piece goods. The prices charged for these will be governed by the need to recover the overhead expenses, to meet competition, and to obtain a sufficient profit. As a general rule competition keeps prices fairly equal for equal qualities, and therefore the chief weapon the electrical retailer has against competition is the service he gives in other directions.

Service needs some consideration of a definite kind here for this very reason. It embraces the assembling and distribution of the goods, and, even more important, the complete acceptance of the principle that "no transaction is truly and thoroughly commercial unless both parties to it are better off than if this transaction had not occurred. Any sale which does not benefit the buyer as well as give profit to the seller is not a commercial transaction. It has the nature of a "social disservice," as a great writer on the economics of selling aptly phrases it.

Service means the acknowledgment of all reasonable complaints and the adjustment even of unreasonable ones. It has been said that the test of good retail sales management is the way in which an unreasonable complaint is handled. The best way is to treat the unreasonable complaint as if it were reasonable. Thus, if a customer returns an appliance as unsatisfactory, though obviously the fault lies with himself, it will in the long run pay to act as though he were sincere, and to make whatever explanations and demonstrations are necessary in as tactful and polite a manner as possible.

The author has not attempted in this article to do more than touch upon the various factors in good retail sales management.

The Costing of Winding and Insulating Coils.—III.

By F. C. LAWRENCE, M.C., B.Sc.Tech., A.M.I.E.E., A.C.W.A., Chartered Electrical Engineer.

Cylinders and Wrapping Materials.

In the case of Haefely wrapping material and varnished paper cylinders, it happens that, before the machines are periodically cleaned, the work has to be stopped entirely, so that any work being done is completed before the stoppage for cleaning. This stoppage can be made to coincide with the end of a process period, thereby ensuring that the value of the work in progress, at that time, is always nil. Provided that unused raw materials are returned to stock, and the process credited with their values, the costing can then be accurately performed.

Shellac Varnish Mixing.

The varnishes required for the mica varnish and other similar products can, of course, be purchased from varnish makers; but their manufacture provides an interesting costing problem, which, unless the varnishes are made on a very large scale, is somewhat difficult of solution.

The mixing of shellac varnish consists of stirring shellac into methylated spirit, either by hand or by machine, and so regulating the mixture that the final product is of a definite specific gravity. In electrical work it is probable that four or five different densities will constantly be required. It is possible, of course, to keep separate the manufacture and the supplies of each density and to pass the shellac through automatic weighing hoppers in order to arrive at perfectly accurate costs and losses for each of them, but the introduction of such elaborate methods is scarcely to be recommended where only small quantities are made. It will be found sufficient to determine overall costs and losses of the whole process, and to distribute the cost over the different densities on what is judged to be a sound basis.

The actual segregation of costs can be done by calculation of the weights of shellac per gallon of varnish required for each of the densities.

Supposing there are three varnishes made, A, B and C, and that the weights of shellac per gallon are x, y and z, respectively. If the following quantities of varnish are produced, 75 gallons, 100 gallons, and 150 gallons, the total weight of the shellac in the final product is $75x+100y+150z$. The amount of shellac actually required will be greater, owing to losses, so that, if w be the total quantity used, the loss will be

$$w-(75x+100y+150z) \quad \ldots\ldots (1)$$

The weight of shellac in the final product A will be $75x$, but the figure upon which the cost of material has to be based must contain due allowance for wastage, and it will be sufficient for practical purposes (so long as the total waste is small) to suppose that each density contributes to the wastage in proportion to the quantity of shellac in it. Thus the weight of shellac used to make 75 gallons of A is taken to be:—

$$w \times 75x/\ (75x+100y+150z) \quad \ldots\ldots (2)$$

The weight of shellac required to make B and C may be found in a similar manner.

The total wastage as given by expression (1) is the important figure for control purposes, and the comparative efficiency of the process may be gauged by the ratio:—

Total wastage of shellac/total weight of shellac in varnish produced $= [w-(75x+100y+150z)]/(75x+100y+150z)$ ..... (3)

Expressed as a percentage, this result can be used as an index, which will give true comparisons of the wastage of the process, and will indicate the extent of improvements, resulting from the introduction of more economic methods, and will ensure that inefficiencies are not neglected.

Turning now to the labour distribution, it is obvious that, in the manufacture of small quantities of varnish, one man cannot devote his whole time to each density, or definitely divide his time between the various densities, and it is probable that, in many cases, one man will do the whole job. The booking of his labour to each density, every time he turns his attention to another pot, would probably be tedious, and it is suggested that, since the amount of attention and stirring required depends, chiefly, upon the amount of shellac introduced into each mixture, the man should book the whole of his time to the process and the labour cost should then be divided in the ratio of the weights of shellac required by each density as calculated above.

If w lb. of shellac is used, costing p pence per lb., the cost of shellac will be wp pence, and, if the total cost of labour for the period is L pence, the total labour and material cost, $L+wp$ pence, may be substituted for w in the expression (2) to give the labour and material cost for varnish A. Similarly, the prime cost is deduced for B and C.

Special Varnishes.

Beside shellac varnish, other special varnishes are made. If these are turned out in fairly large quantities, the method of costing described for shellac varnish may be employed. But, it is usually found that only small quantities are required, at infrequent intervals, so that, instead of a continuous process, there will be separate mixings for each consignment. In such cases it is not worth while doing more than to take "observation test" costs, occasionally. The manufacture should be watched throughout a complete mixing, the ingredients carefully weighed, and the times of preparation, stirring, heating, &c., noted. From this data, the cost can be calculated.

Whilst considering the varnish problem, it should be noted that the varnishes are made, in general, for immediate consumption, so that they pass into the work in progress of the insulating sections without the intervention of a stores. That being so, the varnish mixer or his foreman should be requisitioned for all supplies, and the requisition or delivery note should contain the amounts delivered and their destination, booked in line with the routine described for the mica varnish products. From these notes the cost clerk will be able to check the output figures of varnish with the ingredients used.

The Enamelling of Wire.

There are many minor processes which require as one of their materials, some form of enamel, paint or varnish; a few examples will be quoted, and the method of costing set out.

The enamelling of cotton covered, heavy-gauge wire is a simple process, in which the wire is run from one drum on to another through a bath of enamel.

A process number being allocated, it is easy to book all material and labour to this number, and to compute the weight of wire enamelled each period. The total cost of the process divided by the weight of wire treated, will give the cost of enamelling per lb. of wire, and each drum treated can be charged at this rate.

Stove Enamelling.

The costing of stove enamelling provides some difficulty, as the operations of washing or cleaning, brush or dip enamelling and stoving may have to be repeated, if called for in the specification.

It is practically impossible to book all labour and material to pieces or batches of parts without using reams of paper and wasting much time. The best method to arrive at reasonably accurate costs is to grade

the pieces according to their sizes (for the most part the pieces will be small and of approximately the same superficial area), and regard each division as a separate process to be costed by the week or month.

The number of pieces enamelled, the materials used and the labour employed in each grade should be scheduled in the shops, and from these particulars the cost per piece for enamelling can be ascertained. If there is a wide range of sizes, the simplest expedient is to introduce an "area factor," denoting the pieces which are most often enamelled by unity and others *pro rata*, according to their superficial area.

The sum of the area factors for all the pieces enamelled during a period may be termed the "gross area factor." If the total cost is divided by this factor, the quotient may be called the "unity cost," and it will represent the cost of stove enamelling pieces which are of unity area factor. The cost of enamelling other pieces is derived by multiplying the unity cost by the area factor of the piece concerned.

An example will make clear the procedure. Meter cases and circuit-breaker cases, some of the latter enamelled twice, are found to give the following results:—

(*a*) Meter cases, 1,000 enamelled in one week, each with a superficial area of 240 square inches.

(*b*) Circuit-breaker cases, 200 enamelled in one week, each with a superficial area of 360 square inches, 50 of them being enamelled twice.

Total factory cost of process for the 1,200 pieces £60 0 0

[Average cost = $\frac{£60}{1,200}$ = 1 0 ea.]

Taking the area factor for meter cases = 1

Area factor for breaker cases = $\frac{360}{240}$ = 1.5

and the area factor for those enamelled twice = 2 × 1.5 = 3

Gross area factor = 1,000 + 150 × 1.5 + 50 × 3 = 1,425

Hence, the unity cost, *i.e.*, the cost of stove enamelling the meter cases = $\frac{£60}{1,425}$ = 10.47d. each

and the cost of enamelling the 150 breaker cases once is 10.47 × 1.5 d. = 15.71d.

and of the enamelling of 50 twice 10.47 × 3 d. = 31.41d. each.

The distribution account for this process will read as follows:—

Dr. To total cost of process	=	£60	0	0
Cr. By 1,000 meter cases at 10.47d. each	=	43	12	6
150 breaker cases at 15.71d. each	=	9	16	5
50 breaker cases at 31.41d. each	=	6	10	11
		£59	19	10
Deficit				2
		£60	0	0

It is only necessary for the shops to book the labour and material, each period, to the process number instead of to each batch of meter cases, and to indicate the number of repeats. With this information, the cost clerk is able to arrive at the unit costs and, though he has several calculations to perform, they will be far less than if he had to distribute the cost to orders directly from the job tickets and requisitions.

The form reproduced in fig. 3 (p. 279) can be used with advantage for comparing periodic costs of enamelling and of varnish mixing and as a record for charging out these products.

The Measurement of Stock.

It should be noted that where large supplies of enamel, varnish, oil or gums are used in a process, as is the case in several of the processes cited, the difficulty of measuring the stock in the hands of the workmen at the beginning and the end of the process period is obviated by the simple expedient of fixing a standard level in each tank, up to which, on the last day of each period, the tank is filled.

This can be done by painting a broad white band inside the tank, on which is marked, at the required level, a thin dark band, up to which the tank should be filled. Alternatively, it may be more convenient in some cases to have a needle gauge set to a fixed level.

Besides the varnish, &c., in the tanks there will be barrels, partly full, which, since they represent relatively small quantities, need only be measured roughly.

Asbestos Cloth.

The treatment of asbestos cloth with hard drying varnishes is another process which may be studied with advantage.

The operations consist in dipping the cloth in tanks of varnish and pressing them, in a steam-heated press, four or more at a time so as to form solid boards, the edges of which are trimmed, and finally the boards are sawn into wedges, blocks, &c., to be used in the insulation of the windings of motors, generators, transformers, &c.

The sawing operations are dealt with at a later stage, and it remains to consider the preparatory operations involved in the manufacture and trimming of the boards.

The weights of materials used and the weight of the product after trimming are ascertained each period, as is the labour, and from this data the cost per lb. of product is determined by process costing.

The difference between the finished weight and the sum of the weights of the materials used, consists of direct wastages and of wastage in trimming. The latter is unavoidable, but its amount may vary owing to the manner in which the material is pressed. The wastage could be sub-divided into trimming loss, evaporation and shrinkage, and other losses, but it is quite easy to make allowances for normal trimmings, shrinkage and evaporation, and to consider any loss above such a figure as calling for immediate investigation and explanation.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New "R.I." Transformer.

In view of the claim that some quarter of a million low-frequency inter-valve transformers made by MESSRS. RADIO INSTRUMENTS, LTD., of 12, Hyde Street, New Oxford Street, London, W.C.1, are in use, notwithstanding the fact that the design has remained unaltered for two years, the announcement that a new type is being placed upon the market is of some interest. Moreover, this is the first firm to publish a test curve prepared by the National Physical Laboratory of a standard radio component—an example worthy of being followed by others. The N.P.L. calibration curve is reproduced in fig. 1, and the section of the transformer is shown in fig. 2, p. 320.

The "R.I." transformer has windings in which insulation is provided between layers, in addition to that between individual turns. The self-capacity of the windings as measured by the National Physical Laboratory is 60 micro-micro-farads, but a new method of winding has been evolved which results in a self-capacity for the complete coil of only 18 micro-micro-farads when measured at a frequency of 750 cycles.

In the new model the primary and secondary windings are each sub-divided into six sections, as shown in fig. 2; the six primary sections are now situated on the *outside* of the six secondary sections, whereas in the old model the primary is on the inside nearest the core. The reduction of the self-capacity reduces one of the chief causes of distortion and enables a greater degree of amplification to be obtained at the higher frequencies.

The bobbin on which the coil of the new model is wound is built up of special insulating material into six main sections, the whole bobbin being finally baked after impregnation with an insulating compound. The construction of the bobbin is shown in fig. 3.

The laminated core is built of Stalloy stampings interleaved to prevent eddy-current losses, and no holes are drilled in the laminations. The gauge of wire used has been also increased, so that the possibility of breakdown has been

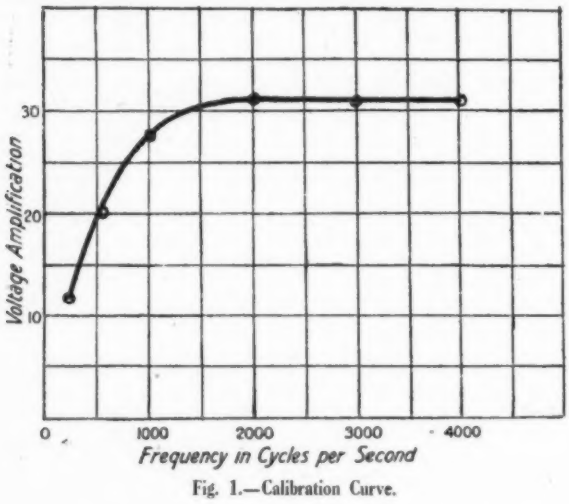
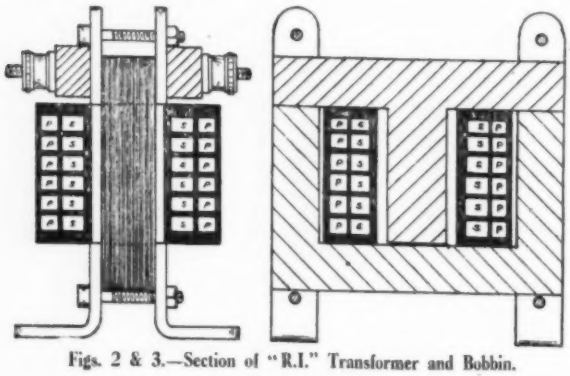


Fig. 1.—Calibration Curve.

reduced. The primary has 3,000 turns, *i.e.*, 500 turns per section, and the secondary 12,000 turns, or 2,000 turns per section; thus a primary impedance of 11 henries and a secondary impedance of 160 henries is obtained, with a transformation ratio of 4-1.



Figs. 2 & 3.—Section of "R.I." Transformer and Bobbin.

We have used one of these transformers in a simple two-valve and crystal circuit, four miles from 2 LO, and obtained excellent results from the loud speaker as regards volume of sound and freedom from distortion.

A New Fuse Element.

A new fuse, called the "Zenal" fuse element, has been developed in the laboratory of MESSRS. FARMITER, HOPE AND SUGDEN, LTD., Hulme Electrical Works, Manchester, which possesses unique features of technical interest. If copper is used as a fuse element the margin between the carrying capacity at a non-oxidising temperature and the blowing current is excessively wide, whilst, if tin is used, as is recommended by the Sub-Committee on Earthing of the Institution of Electrical Engineers, the mass of metal to be volatilised when the fuse blows on even a limited overload is such as to be a great danger.

The "Zenal" fuse element is of pure copper, the temperature of which is controlled by the insertion in a portion of its length (preferably the centre) of a plug melting at a low temperature, and so arranged that as soon as the temperature of the strip rises to the melting point of this plug, and the plug has melted and run out, the fuse must blow immediately. The tin flows out through a small hole bored at the bottom of the plug. Copper is deposited electrically over the tin to

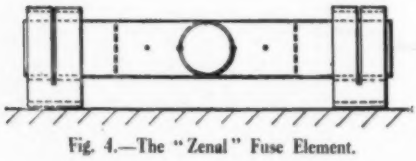


Fig. 4.—The "Zenal" Fuse Element.

form a pocket, which serves two useful purposes: the skin effect of tin when melting is minimised, and also the copper covering delays the actual rupturing of the element until the tin has had time to run out.

To prevent a very excessive current passing on a short circuit or heavy overload, a series of small slots is made at both ends of the copper element; on a severe short circuit the centre pocket is seldom involved, and the actual rupture takes place in the narrow copper connecting paths. A valuable feature claimed for this fuse is that the engineer can generally judge afterwards, from an examination of the remains of the element after fusing, what current was passing at the time of fusing. The position and size of the above-mentioned slots have been carefully determined, and the result is said to be a perfectly accurate and reliable "cut-off" on short circuit.

With copper as a fuse element, the pressure drop across

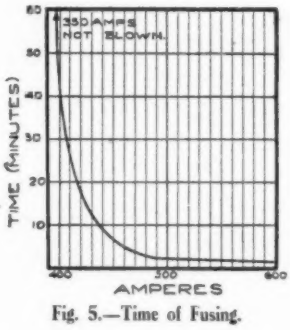


Fig. 5.—Time of Fusing.

a good or bad contact is a very small percentage of the total drop across the fuse, and therefore it is the element itself which is the important matter. The curve, fig. 5, shows plainly the advantage of this new device; an element capable of carrying 350 amperes continuously blows in 40 minutes at 400 amperes, in 2 minutes at 500 amperes, and almost instantaneously on short circuit.

A Metal-sheathed Appliance Connector.

The AUTOMATIC TELEPHONE MFG. CO., LTD., Milton Road, Edge Lane, Liverpool, has sent us a sample of a new type of metal-sheathed connector which it has designed as an improvement for its "Xcel" heating and cooking appliances. This is provided with a pressed-brass nickel-plated case with tough porcelain interior, embodying the great advantage of the side entrance for the flexible. This takes the flexible away from the user's arm, and considerably increases the life of the flexible because it takes a much larger sweep than that of a vertically connected flexible, and is accordingly much less liable to get into a tangle.

In addition, should the flexible fracture with the current on, there is no liability to cause a burn, which might be the

Fig. 6.—A Metal-sheathed Appliance Connector.

case with the flexible attached in the ordinary manner. The side entrance spring has been made weaker so as to allow it to move in consonance with the flexible, acting as a flexible support rather than a rigid entrance; this has been found to give increased life to the flexible. All parts are easily and cheaply renewable and interchangeable.

Combustion Engineer's Slide Rule.

A handy slide rule, designed by Mr. H. W. Healy, is being issued by the VICKERS-SPEARING BOILER CO., LTD., of 20, Kingsway, London, W.C.2, the sole licensees. Starting with

Fig. 7.—A Slide Rule for Combustion Engineers.

the cost per ton of fuel and its calorific value in B.th.u., the rule enables the cost per million B.th.u. to be read off; this figure is then used, in conjunction with the boiler efficiency, to give the cost of evaporating 1,000 gallons of water from and

at 212 deg. F. One of the scales provides for ascertaining the calorific value of the fuel when the percentage of non-combustibles is known (*i.e.*, ash plus free and hygroscopic moisture), the relation being empirical but giving approximately the correct "available as fired value" for bituminous coals.

The rule is neatly produced, of celluloid mounted on cedar, with a glass cursor, and should prove very useful to coal buyers and users.

Lamp-locking Devices.

Whilst the problem of locking lamps in bayonet holders has been solved in various ways, it has proved much more difficult to lock those of the Edison screw type. Messrs. LAMLOK, LTD., of 237, Acton Lane, Chiswick, have, however, succeeded in providing an effective means of accomplishing this object. As shown in fig. 9, it consists of a substantial brass frame, branching into a loop to clasp the pip end of the lamp, whilst the legs pass through arms projecting from a ring and are secured by means of the well-known "Lamlok" screws. The ring surrounds the holder above the porcelain insulator, and is keyed on the holder, so that it is impossible to remove it or to release the locking frame without violence,

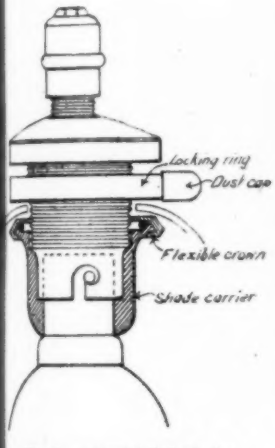


Fig. 8.—"Lamlok" Lock for B.C. Lamp and Shade.

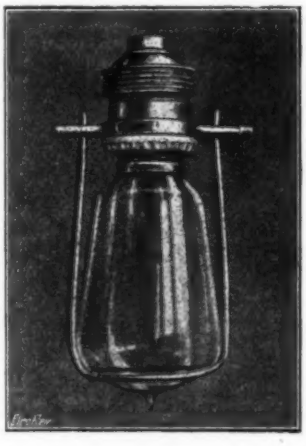


Fig. 9.—"Lamlok" Lock for Edison-screw Lamps.

involving the destruction of the lamp, when locked, except by legitimate means. The device allows for variation in the length of the lamp and cap, being self-adjusting, and there is no difficulty in attaching it to existing holders.

For the purpose of locking bayonet-cap lamps fitted with shades of narrow mouth, &c., Messrs. Lamlok have introduced the device shown in fig. 8. From the sketch it will be seen that the shade is supported on a special flexible carrier which rests on the collar of the lamp; when the lamp, with the shade-carrier and shade in position, has been inserted in the holder, a locking ring is screwed down on the top of the shade, and fixed in place by the Lamlok screw. The lamp and shade are then securely locked. We understand that all the new vessels of the P. & O. Company are being fitted with this device.

The Ministry of Transport.

Annual Report.—(*Abstract*).

THE report of the Minister of Transport respecting the proceedings of the Ministry under the Electricity (Supply) Acts for the twelve months ended March 31st, 1924,* shows that during the year under review the South-East Lancashire and South-West Midlands Electricity Districts Orders came into operation, while the North Wales and Mid-Lancashire Orders were confirmed; the East Midlands Order had not been confirmed at the date of the report.

The Minister also confirmed 65 Special Orders made by the Electricity Commissioners; 32 of them were promoted by companies, 28 by municipalities, and five by individuals. At the date of the report, seven Special Orders were under consideration, four of them being promoted by companies, two by municipalities, and one by an individual.

The Orders made granting a revision of maximum prices numbered 55, public inquiries having been held in 13 cases; the Minister has revoked six Orders and deferred the revocation of three others, while the West Cumberland Electric Tramways Acts, 1901 and 1903, have been revoked in so far as they relate to the supply of electricity. An Order has also been made for the cesser of the powers of the undertakers under the Somerset and District Electric Power Act, 1903.

The Minister's consent has been given to the erection of overhead lines under 101 Acts or Orders: the number of consents vary from one to ten; one case is an extension. Six applications for consent for wayleaves were dealt with; in four cases consent was given and rentals were prescribed; in one case where a settlement was arrived at, no consent was necessary, while in another the route was altered and the application withdrawn. In each case where the Minister gave a decision, a local inquiry was previously held.

The Minister of Transport, as successor to the Board of Trade, and with the approval of the Treasury, has fixed the fees for the examination and testing at the National Physical Laboratory of meter types submitted to the Electricity Commissioners for approval.

The Minister approved an estimate submitted by the Electricity Commissioners of their receipts and expenditure during the financial year ending March 31st, 1924. The amount of the estimate so approved was £75,000 (compared with £79,000 for the previous year) comprising £44,250 in respect of the net administrative expenses of the Commissioners during the year 1923/24, and £30,750 in respect of the repayment to H.M. Treasury of the second instalment of the advances made to meet the expenses of the Commissioners during the first two years after the passing of the Act of 1919, together with interest on such advances. The Electricity Commissioners will issue a separate report dealing fully with their proceedings during the period under review, but the chief matters dealt with are set out below:—

Substantial progress was made by the Commissioners during the year with the reorganisation of the supply of electricity in various districts. In addition to the approved schemes which were in an advanced stage at the beginning of the year, the Commissioners published other approved schemes in respect of six further districts, and held or commenced local inquiries in respect of five of them, and Orders were made establishing Electricity Authorities for the North Wales, Mid-Lancashire, and East Midlands Electricity Districts.

The Commissioners have consented in the case of 26 applications relating to the establishment of new generating stations (10 statutory and 16 non-statutory), in the case of 92 applications relating to the extension of existing generating stations, and in the case of 26 applications relating to the establishment of main transmission lines. The new generating stations sanctioned during the year represent the initial installation of approximately 53,000 kW of generating plant, while the authorised extensions of existing stations represent the installation of approximately 428,000 kW of generating plant, the total capacity of the plant sanctioned thus being approximately 481,000 kW.

During the year under review the Commissioners received 542 applications from local authority undertakers for sanction to borrow money for electricity purposes. At the beginning of the year there were 123 applications received in previous years which had not been disposed of. Sanctions were issued during the year in respect of 547 applications; 17 applications were transferred to other departments or were withdrawn by the authorities concerned, leaving 101 applications in respect of which no loan sanction had been issued up to March 31st, 1924. The total amount of the loans sanctioned during the year was £9,836,987.

The Commissioners have approved in 16 cases of agreements being entered into between authorised undertakers for mutual assistance or for the taking of bulk supplies, and have made 80 Orders permitting authorised undertakers to supply electricity to specific premises situate outside their authorised areas of supply. They have approved the adoption of special systems of supply in the case of 33 undertakers, and have also in 24 cases consented to the alteration of the system and/or pressure at which electricity is supplied to consumers.

The Commissioners have dealt with a number of applications referred to them by the Unemployment Grants Committee for approval of electricity supply works proposed to be carried out by local authorities with the aid of grants from that Committee for the relief of unemployment. The Commissioners have assisted the Trade Facilities Act Advisory Committee in a consultative capacity in connection with the applications for Government guarantees in respect of electricity supply schemes.

*H.M. Stationery Office; price 9d. net.

The Rensselaer Institute Centenary.—The centenary of the Rensselaer Polytechnic Institute, which is claimed to be the oldest school of science and engineering in any English speaking country, is to be celebrated at Troy, N.Y., U.S.A., on October 3rd and 4th next, when delegates from scientific organisations in all parts of the world are expected to be present.

Outdoor Condensers.—In the United States static condensers for power-factor correction have been successfully installed out of doors, on poles, &c., and have operated for over a year without a failure.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Small Consumer.

Much has been written concerning the backwardness of England in the matter of utilisation of electricity for domestic purposes: too often it is John Citizen who is blamed for not recognising the advantages of the electric home. At the local gas company's showroom recently I was given the names of a number of electrical engineers in this city who use gas exclusively; I am likely shortly to be added to their number, and doubtless their reasons for installing gas were the same as my own.

Some nine months ago, before my house was built, I inquired as to the possibility of obtaining a supply of electricity; I was politely informed that the matter would be investigated and that I should hear in the course of a few posts!

A further letter brought no reply.

Now, after nearly a year, it is politely intimated that the small consumer simply is not wanted.

I may mention that my house is on an arterial road, electric tramcars go past my door and a mile beyond, and within a few yards are some twenty or thirty occupied houses with others in course of construction.

The story of the old lady who declined to have electric light because she hadn't even got the gas in yet is accepted in all seriousness in this district.

Electron.

August 23rd, 1924.

Electric Iron Risks.

With reference to Mr. Standish's letter the difficulty can be got over fairly simply, as a little thought will show, by providing triple flex from iron to adaptor, upon which is fixed a clipping arrangement that automatically connects with the lampholder, which must be earthed to the conduit by triple flex or separate conductor. In the case of non-earthed systems, obviously some other earthing point will have to be found. I have a satisfactory device for the purpose that I am not a liberty to describe at the moment, as it forms the subject matter of a pending patent specification.

A. Burns.

August 25th, 1924.

Electricity v. Gas.

Referring to "A.M.I.E.E.'s" letter in your issue of the 22nd inst., I am sorry that your correspondent has thought fit to challenge my figures on the thermal efficiency of gas production. No advantage can accure in the long run by unnecessarily using values and figures which are not being obtained in everyday present practice. If he will use the following figures instead of and in addition to his own, he will be on safe ground, and will be able to see the matter in true perspective:—

Coal	13,400	B.th.u. per lb.
Gas	5,800	B.th.u. from 1 lb. of coal
Coke and breeze	8,318	" " "
Tar, ammonia, carbon and sulphur	1,013	" " "

There is no point in disallowing the heat from the last item, simply because these substances are not used for heating purposes. The commercial value of these materials is far too great to allow of their being wasted in heating, this being one of the ways in which the gas-making process enables its real heating products (gas and coke) to be sold at a far cheaper rate than a heat balance sheet would appear to justify.

In my letter of the 15th instant, I asked your readers to accept my figures, and I do not propose further to discuss this aspect of the subject. They are such as are obtained in regular practice, and can be easily verified by anyone interested.

With regard to the 75 per cent. efficiency of the modern gas fire, this was in direct answer to Mr. Ryland's question. If he had asked for the efficiency of other apparatus, I should have answered him accordingly.

Your correspondent's statement as to the combined thermal efficiency in use of gas and coke being not more than 30 per cent. is a very general statement, and is really not of much value. I believe it would be more difficult for him to substantiate his figure, than for me to refute it. Again, I appeal to him to bring his efficiency figure for the modern gas engine up to date. As far back as 1910, Dr. Dugald Clark (perhaps the greatest authority on gas engine design and practice) found efficiencies of 37 per cent. in a comparatively small gas engine, and I assure you that the experience of the ensuing 14 years has not been wasted. In addition, 90 per cent. of the heat value of the exhaust gases may be recovered in a well-known form of waste-heat boiler.

Nothing but the fact that it might be thought to be a quibble, prevents me from asking if the 20 per cent. overall thermal efficiency of electricity production and use is a figure that electrical engineers can generally guarantee.

I am glad to find your correspondent in agreement on the vital subject of the combined production of gas and electricity. Thermal efficiencies are important, but were the efficiency of electricity much lower than it is, and were the efficiency of gas production higher than it is, it would not affect the fact that both gas and electricity are necessities of modern life and must be produced at any cost. My point is that it is our duty to the nation and to our successors that they shall be produced in the most efficient manner, and with the least real destruction of coal that our ingenuity can devise.

J. R. Bradshaw,
Engineer and Manager.

Corporation Gas and Water Works,
Retford, *August 23rd*, 1924.

Church Heating.

We did not expect such an unkind reply to our inquiry as the one given by "Modest Consultant," and we are very sorry we have caused him to go out of his way to be so vulgarly abusive. We know consulting engineers too well to think any the less of them because of such an exhibition of ill-will on the part of one disgruntled specimen. We have received numerous helpful and kind letters from other readers, most of which indicate that the problem has several points of interest.

If "Modest Consultant" can help us and can give particulars of a similar scheme successfully solved which is available for our inspection, we shall certainly be quite willing to pay him a reasonable fee.

We sincerely hope we have not offended *many* of your readers. We have been at the business long enough to realise the limits of our knowledge, and we are very sorry if we have exceeded the bounds of decency by making a "parade of our ignorance" and courting information through your columns.

Smith & Bellhouse.
THOMAS SMITH.

Wolverhampton, *August 23rd*, 1924.

The Retail Wireless Trade.

The recent letters on the subject of wireless prompt me to "put my spoke in," especially after reading the letter of "Radio Engineer."

During the summer each month has brought a crop of receiving orders in bankruptcy against the wireless manufacturer and dealer, and one is tempted to ask why, observing how stable this branch of British industry could be. From various investigations and observations the following facts are obvious: (*a*) Real radio engineers trained as such are scarce, and are found employed by the firms who have made good by selling and manufacturing scientific instruments and components conforming to theoretical and practical considerations. (*b*) The dealer will employ a youth who has no knowledge of a 4 BA thread, let alone radio calculations, circuits, and considerations. Often the retailer has no conception of the public's requirements, and the suffering purchaser of components is given supposed wireless information of idiotic proportions when spending his pence or pounds in the radio store. (*c*) The awful results obtained on 50 per cent. of the sets constructed or manufactured by the fraternity who follow certain published circuits without attending to details of quality in components. (They even fit radio-frequency valve sets on wooden panels, and use a pencil mark (unprotected from damp) as a grid leak, and my remarks relative to fixed and variable condensers are unfit for publication).

Now (*a*) costs money, the handful of radio engineers require more than £4 per week—their service to a firm is the basis of prosperity. (*b*) Is a necessarily difficult problem, but bearing in mind that it requires a fair education to master thoroughly wireless principles, the dealer and employés in this department cannot be rag-and-bone merchants or comic office boys. This, again, is expensive. Regarding (*c*), many sales are spoilt by such results; the constant: "I would sooner have a gramophone" cry is ever present. Cannot the dealer who sells the complete unscientific set be eliminated?

Probably the following information will help to illustrate more fully my contention. A certain firm advertised for a competent radio engineer. 273 replies were received as the result of a single advertisement, but 272 were from professed radio engineers with less than two years' experience in amateur circles. Twelve of the considered best men were selected for interview, and not one could answer a few of the most simple questions on theoretical radio. Naturally the single real radio engineer got the job, and at his own price, too. Another firm received almost as many replies and selected a B.Sc. (London), age 21, for the job at a very cheap price. His knowledge of radio was the construction of a crystal set. Now you will find in May, 1925, that the first advertiser has made a good profit; it is, however, doubtful if the second one will, for this successful applicant is now a radio designer instead of a radio counter salesman, which position, to my idea, would suit him best, giving an opportunity for practical experience.

This is the time for the dealer and manufacturer to put his house in order for the boom which arrives with the dark evenings, and if at the conclusion of the winter financial worries assail him, then he has himself to blame.

Moral: Make wireless apparatus conforming with the teachings of the last 25 years, advertise the fact in simple technical language, telling the truth, and employ people who know something about wireless, fitting "round pegs in round holes."

F. F.

London, *August 21st*, 1924.

Mathematical Treatises.

With reference to the inquiry by "R. S." in the current issue of the REVIEW, there are really no treatises on the desired subjects, provided with keys. Almost all, however, give specimen solutions in the text, and although it is difficult to advise without knowing the extent of previous reading, and also the purpose of study, the following list may satisfy your correspondent's requirements:—

Co-ordinate Geometry—
Salmon, Analytical Geometry of Three Dimensions.
Darboux, Théorie générale des Surfaces. (This book also deals with Differential Geometry.)

Calculus—
Greenhill, Differential and Integral Calculus. (This book on the Calculus is, I think, more often referred to in engineering literature than any other; *e.g.*, see Russell, "Alternating Currents," Vol. I, and Kennelly, "Artificial Electric Lines.")
Lamb, Infinitesimal Calculus. (Includes chapters on Diff. Equations.)
Edwards, Differential Calculus.
Edwards, Integral Calculus.

Mechanics—
Lamb, Statics and Dynamics.
Routh, Analytical Statics.
Routh, Rigid Dynamics.

Differential Geometry—
For this subject it is necessary to have a knowledge of Differential Equations. Forsyth has a single-volume Treatise on the subject, published by MacMillan. He has also written a much larger one, published by the Cambridge University Press in 6 vols., which is useful for reference purposes.

On the subject of "Differential Geometry," see books of this title by Forsyth and Eisenhart.

It is recommended that before commencing the study of Advanced Calculus, a good book on "Theory of Infinite Series," such as that by Bromwich, be studied. The theory of Limits is also important, but steer clear of modern Number-Theory.

T. W. J. Powell.

Cosham, *August 22nd*, 1924.

Regulations for the Electrical Equipment of Buildings.

I have been looking over the June, 1924, Eighth Edition of the above I.E.E. regulations.

For the benefit of electrical engineers there is a glossary of "definitions" occupying nine or ten pages. One would imagine that this would only be of use to a boy of 12 or 14 years of age. A few samples are as follows:—

"*Consumer's terminals*" means "the ends of the electric conductors," &c., &c.

"*Earthed*" means "connected to the general mass of earth," &c.

"*Cable*" denotes "one or more conductors with insulating covering," &c.

"*Single-Pole Switch*" is one suitable "for making or breaking a circuit on one pole," &c.

"*Sub Circuit*," "Is a branch circuit," &c., and so on.

A prize might also be offered for the best solution of the meaning of the following:—

"95. *Subdivision of Circuits.*

A. The maximum number of points that may be connected in parallel to a final sub-circuit shall be as follows:—

"Where the total rating of the points supplied from the sub-circuit does not exceed

6	amperes	10	points
8	"	6	"
10	"	4	"
20	"	2	"

"Final sub-circuits supplying one lamp or appliance are not limited as to current-carrying capacity." Then they carry on B and:—

"C. Every sub-distribution board shall be connected to a separate way on a main distribution board. Each main distribution board shall in turn be connected either to a separate way on the main switchboard or to one way of a distribution board for larger currents, which in turn shall be connected," &c., &c.

All this reads like "Big fleas have little fleas, &c.—*ad infinitum.*"

Tables XIII and XIV give no information about stranded fuses, so that the erroneous idea, that doubling the fuse wire doubles the carrying capacity, will continue.

X. Y. Z.

London, *August 21st*, 1924.

The Inefficiency of Boiling Rings.

There certainly seems to be room for improvement in the design of electrical heating apparatus in this country.

A well-known Continental firm produces a heating element which is practically indestructible. The heating wire is embedded in an electrically insulating, heat conducting, stone mass, in which the wire is perfectly secure against overheating, moisture, and mechanical damage—in fact, just what our long-suffering public is seeking.

H. Horowitz.

London, *August 22nd*, 1924.

Legal.

False Pretences Charge.

HENRY HAINES SPINNEY, alias Turner and Haines, 49, described as an electrical engineer, of Miles Street, Wandsworth Road, was charged at Westminster Police Court on August 20th, with obtaining by false pretences electrical fittings, &c., valued at over £17, from Mr. G. M. Chrussachi, of Wyvert Road, N.W. A further charge of obtaining wireless accessories from Messrs. S. P. Catterson and Sons, of Newington Causeway, was also preferred. Mr. SAUNDERS, prosecuting for the Commissioner of Police, said there would be other similar charges. The evidence would show that accused had rented for a little while a small lock-up shop in Miles Street, Wandsworth Road, which was empty, except for rubbish left by a former occupier. He traded in the name of "Brown and Polson," but lived at Rowton House as "Mr. Turner," and in his locker there a detective-sergeant discovered a number of printed order forms, in the name of Brown and Polson, dealers in wireless apparatus. On July 23 he called at the works of Mr. Chrussachi, produced an order form, and obtained some wireless apparatus which he said he wanted to test. Later he said this was satisfactory and ordered more, at the same time stating that he was forwarding a cheque. Subsequently he obtained further goods from the same firm, promising to pay on delivery. He did not do this, however, but took the goods from a messenger boy, saying that a cheque would be sent. In another case accused obtained goods by saying he was acting for "Roberts and Co.," and in a third he represented himself as acting for "Haines and Glynn." When arrested, he said he had had the goods, but it was a matter of civil, not criminal, liability. Spinney was remanded.—*Daily Telegraph.*

Copper Specifications.—The British Engineering Standards Association has recently issued five Specifications for different grades of raw copper, namely No. 199-1924, Electrolytic Copper Ingots and Ingot Bars; No. 200-1924, Tough Copper Cakes and Billets for Rolling; No. 201-1924, Fine Copper Cakes for Rolling; No. 202-1924, Electrolytic Cathode Copper; and No. 203-1924, "Best-Select" Copper. A sixth Specification, covering electrolytic copper wire bars, cakes, slabs, and billets, will be published shortly. The Specifications have been drawn up with extreme care and after prolonged study on the one hand, of the requirements of the various users of copper, their standards of desirable material, &c., and, on the other hand, of the actual and possible standards of purity of the various coppers now being marketed by producers. The aim has been to make the Specifications sufficiently exacting to maintain and improve the quality of raw material already being supplied to high purities, and at the same time to leave them elastic enough for ordinary metal market use. Copies of the Specifications may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W., price 1s. 2d. each, post free.

Periscopes for Oil Circuit Breakers.—For the purpose of readily determining the condition existing inside the tanks of large oil circuit-breakers without the necessity of emptying the oil, the Westinghouse Electric Co. has perfected a sight tube, built on the principle of the periscope and so designed that the contacts of the breaker can be easily inspected by the operator from a position outside the tank. The use of this sight tube saves a great deal of time; breaker contacts can be inspected with the new device in 15 minutes, a valuable saving when the breaker is on an important line. The tube, which is built in the same manner as an ordinary stove-pipe periscope, has in a bulb-shaped compartment a 100-watt lamp placed so that its rays illuminate the area in front of the lower sighting hole of the tube. A mirror, directly above this lamp and opposite a glass-covered opening in the tube, is placed at an angle of 45 degrees to the perpendicular axis of the tube so that it reflects an image of whatever is illuminated by the lamp.

Business Notes.

Bankruptcy Proceedings.—J. BURKETT, electrical engineer, 185, John Clay Street, and 78, Anderson Street, both South Shields, Durham.—The first meeting of the creditors herein was held on August 20th at the Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. The statement of affairs showed liabilities of £289 and assets of £71, leaving a deficiency of £218. Debtor attributed his failure to bad debts, law costs, interest on loans and depreciation of stock. He stated that he commenced business in February of last year, with a capital of £40.

The following are creditors herein :—

	£		£
Carr, Ltd., Walter	50	Metallic Electric Engineering Co.	20
Coulson	20	Waltons Wireless, Ltd.	20
Metropolitan-Vickers Electrical Co., Ltd.	79	Gledson & Co., Jas. ... ... Bankers	30 24

L. A. RADFORD, electrical engineer, 50, Welford Road, Leicester.—The public examination of this debtor was held recently at the Castle, Leicester. The statement of affairs showed liabilities of £321, with a deficiency of £175. Debtor said that he entered into partnership with another at the above address, and put £50 into the business, but he did not know how much the partner put in. He stated that the partnership was not a success, and the partner left the business. After further questions the examination was adjourned.

SIDNEY ARTHUR WARDELL, electrical engineer, 83, Raleigh Road, Richmond, Surrey.—The following are creditors herein :—

	£		£
Falk, Stadelmann & Co., Ltd....	191	Wardell, F. W.	32
Electrical Supplies Co.	100	Bankers	25
Latters, Ltd., F. S.	114	Lake, W. J., & Son	60

S. HOLMES, 5, Gibson Street, Burmantofts, Leeds, electrical engineer.—The receiving order in this matter was made on July 28th on debtor's own petition. The statement of affairs shows liabilities of £249, against assets of £205. The first meeting of the creditors was held on August 14th at the Official Receiver's office, Leeds, when the case, being a summary one, was left with the Official Receiver as trustee of the estate. The following are creditors :—

	£		£
Liversedge, Mrs.	50	Metropolitan-Vickers Electrical Co., Ltd.	34
Milne & Son, Ltd.	31	Bankers	48
Scattergood & Johnson	43		

D. C. FIELDING, 48a, Cloth Market, Newcastle-on-Tyne, wireless dealer.—The receiving order in this matter was made on July 11th on debtor's own petition. The statement of affairs shows liabilities of £2,882, against assets of £555. The first meeting of the creditors was held on July 30th at the Official Receiver's office, Newcastle-on-Tyne. The adjourned public examination was held recently at the County Court, Newcastle-upon-Tyne. Debtor said that he had drawn £7 a week from the business and had lost £6 a week. He commenced business in 1921, dealing in gramophones, and in 1922 he dealt in wireless apparatus. He attributed his failure to bad trade and depreciation of stock-in-trade and fixtures. He estimated that he had lost £334 since July, 1923, and his deficiency was put down at £835. The examination was adjourned. The following are creditors :—

	£		£
Ashley Wireless Co.	151	Metropolitan-Vickers Electrical Co., Ltd.	754
Bankers	306	M.E.L., Ltd.	36
Blakey & Son, W.	30	Peronet, Ltd.	26
Bagnall	443	St. Helens Cable Co., Ltd. ...	188
Birmingham Products	35	Swallow Milburn	25
Concordia Wire Co.	109	T.M.C.	33
Dickinson, Wm.	173		
Hunter, G. B.	372		

E. MITTON, electrical and automobile engineer, Queen's Hall Buildings, Church, Lancaster.—Last day for proofs for dividend, September 2nd. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

W. T. ELLIS and C. A. HORNSBY (Ellis & Hornsby), electrical engineers, Gwynfryn, Deganwy Avenue, Llandudno.—Receiving order made August 16th on debtors' own petition.

R. E. EMMOTT, electrical appliance merchant and contractor, 1, Manor Street, Bradford.—Receiving order made August 15th on creditor's petition. First meeting, August 29th, at the Official Receiver's offices, 12, Duke Street, Bradford. Public examination, October 20th, at the County Court, Bradford.

J. A. BOSHER, electrical engineer and contractor, 33, High Street, Aberdare.—First meeting, August 28th, at 34, Park Place, Cardiff. Public examination, October 17th, at the Temperance Hall, Aberdare.

F. H. THOMAS and W. E. EVANS (Thomas & Evans), electrical engineers, Salubrious Chambers, Swansea.—Trustee, Mr. C. H. Harvey, Central Chambers, Fisher Street, Swansea, released July 4th.

F. H. HOOLAHAN (Holloway Bros.), electrical engineer and instrument maker, 16, The Hale, Highams Park, and 299, Holloway Road, N.—Receiving order made August 19th, on debtor's own petition. First meeting, September 3rd. Public examination, December 5th, both at Carey Street, W.C.

C. G. HOFMAN (L. G. Chambers & Co.), wireless component manufacturer and electrical engineer, Andrew Works, Cowthorpe Road, Wandsworth Road, and 7a, Victoria House, South Lambeth Road, S.W.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, appointed August 14th.

H. LEE and A. W. VERITY (Verity & Lee), electrical contractors, 143a, Leeds Road, Bradford.—Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford, released July 31st.

J. HARRIS, electrical and general engineer, King's Head Buildings, Church Street, Nuneaton.—Trustee, Mr. C. J. Band, Official Receiver, 9-11, High Street, Coventry, released August 1st.

F. SMITH, wholesale electrical accessories factor, 6, Imperial Buildings, Dale End, Birmingham.—Last days for proofs for dividend, September 8th. Trustee, Mr. C. T. Appleby, 26, Corporation Street, Birmingham.

Company Liquidations.—RE-ECHO ELECTRICAL MANUFACTURING CO., LTD., 43, Johnson Street, Horseferry Road, Westminster.—The report of Mr. G. D. Pepys, Official Receiver and Liquidator, has been issued. The accounts filed under the liquidation show total liabilities £4,122, assets valued at £1,166, and a total deficiency of £6,954 with regard to contributories, the issued capital being 4,000 ordinary shares of £1 each. According to the liquidator the company was registered as a private company on January 4th, 1923, under the name of the Re-Echo Wireless Manufacturing Co., Ltd., with a nominal capital of £3,000, which was subsequently increased to £4,000. It was formed to acquire and take over as a going concern the business of manufacturers of radio telephone apparatus carried on by S. F. O'Hara and J. B. Bignamy, at 16a, Hatton Wall, Hatton Garden, E.C. The name of the company was changed to the Re-Echo Electrical Manufacturing Co., Ltd., on March 1st, 1923. Under the purchase agreement the company was to take over the plant, machinery, tools, stock, &c., belonging to the vendor's business, the benefit of all pending contracts, together with the exclusive licence to use and exercise the rights and interest in certain inventions in respect of radio aerial tuning inductances, cash at bank, and all other property of the vendors. The consideration was fixed at £2,248, payable as to £250 in cash and as to £1,998 by the allotment of 1,998 fully-paid shares. The first directors appointed by the articles of association were O'Hara, Bignamy, and Captain W. R. Hargroves. O'Hara resigned on February 12th, 1923, on which date Captain C. W. Dann was appointed. W. Taplin was appointed on March 5th, 1923, and he paid £1,400 for 1,000 shares allotted to him. All the above-named persons were appointed as permanent directors. The qualification of each director was the holding of shares of the company to the nominal value of not less than £50, and they all appear to have qualified. No remuneration was fixed, but each director had a service agreement under which he was to receive a salary of £8 per week, Hargroves as managing director and chairman, Bignamy as factory manager, Dann as sales manager, and Taplin as secretary. According to the accounts £1,726 has been paid in respect of these salaries. Dann resigned his position as sales manager in August, 1923.

The issued capital amounts to £4,000, and comprises the 1,998 shares issued as fully paid under the purchase agreement, and 2,002 shares subscribed for cash, as to 1,000 to Hargroves, 1,000 to Taplin, and 2 to the signatories. The £250 cash purchase consideration appears to have been paid out of Hargroves's subscription for shares. A question between the Postmaster-General and the British Broadcasting Co. regarding royalties payable in respect of the user of receiving sets had the effect of causing a depression in the trade, and the company endeavoured to develop an electrical business. In June, 1923, the company was in want of further working capital, and Taplin advanced £1,200 on the security of a debenture for that amount covering the undertaking and assets. In September, 1923, he advanced a further £300, and the debenture was increased by a corresponding amount. In addition to the loans previously referred to, Hargroves and Taplin lent the company £250 each, and a debenture for £500 secured by a second charge on the undertaking and assets was issued jointly to Taplin and Hargroves.

Taplin states that on February 14th, 1924, he appointed Mr. C. F. P. Richards to act as receiver on his behalf as first debenture holder as the other directors proposed to close down owing to creditors pressing for payment and because the debenture interest was in arrear, and on March 28th, 1924, a resolution was passed for the voluntary winding up of the company, and Mr. Richards was appointed liquidator.

The accounts of the company's trading up to the date of the receiver's appointment show a gross loss amounting to about £237, and the failure of the company is, in the opinion of Taplin, due to the high price paid for purchases, depression in the trade, heavy bad debts incurred, and to unexpected liability due in respect of royalties. The receiver for the first debenture holder states that he is carrying on the business in the hope of realising the stock to the best advantage, but he states that the possibility of realising a sum equal to the amount of the first debenture claim is very remote.

TELE-DES SERVICES (FOUNDERS COMPANY), LTD.—A petition for the winding up of this company has been presented to the High Court by the Union Bank of Manchester, creditors, and will be heard in London on October 14th.

MORRIS & LISTER, LTD.—Winding up voluntarily. A meeting of creditors was called for August 28th. Liquidator, Mr. G. A. Lister.

CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD. (Matter No. 00243 of 1914.)—Mr. W. B. Peat, the liquidator of this company, has applied for his release.

Dissolution of Partnership.—SANDERS & Co., jewellers, opticians and dealers in wireless apparatus, 2, Warwick Road, and 18a, Park Street, Bristol.—Mr. F. P. Sanders, Mr. F. G. Blackwell, and Mr. A. R. Fear have dissolved partnership. Debts will be attended to by Messrs. Sanders and Blackwell.

Trade Announcements.—The business carried on at Cork by Mr. P. Fitzgerald, electrical engineer and contractor, has been transferred to a private company, FITZGERALD & Co., 22, Merchant's Quay, and 16, East Beach, Cork. The company desires to receive catalogues of power plant, lighting and pumping equipment, radio apparatus, &c.

Mr. W. C. DAVEY, city manager for the late firm of Messrs. Strode & Co., Ltd., has entered into partnership with Messrs. Davey & Co., telephone and radio engineers, of Mortimer Market, Tottenham Court Road, W.C.1. It is his intention to extend the business to include lighting, heating, power, ventilating, &c. Mr. Chancellor, assistant engineer for the late firm, is his assistant.

Messrs. HEATH PRITCHARD, LTD., 27, Fore Street Avenue, E.C.2, co-patentees of the "G.W." plug and switchbox, have been appointed the sole selling agents of this device.

Messrs. W. T. GLOVER & Co., LTD., announce changes in the addresses of their warehouses as follows:—Manchester: Millgate Buildings, Long Millgate; Birmingham: 36, Cannon Street; Nottingham: 35, Heathcote Street; Newcastle-upon-Tyne: 15, Ward's Buildings, 33, High Bridge; and Cardiff: "Ellenbrook," Bishop's Road, Whitchurch.

AUTOMATIC AND ELECTRIC FURNACES, LTD., has arranged that all Wild-Barfield furnaces of above 25-kW input will in future be designed in conjunction with the Electric Furnace Co., Ltd., Victoria Street, S.W.1.

The new address of MESSRS. R. H. LONGBOTHAM & Co., LTD., is 22, Northumberland Avenue, W.C.2. Telegrams: "Ahraychel, Westrand, London"; telephone: Regent 1599.

Mr. FRANK L. MOORE, electrician, announces that he is carrying on business at 8, Lawn Road, Doncaster.

Catalogues and Lists.—M. MAURICE BOBIN, 21, Warwick Lane, Newgate Street, E.C.4.—An illustrated and priced leaflet describing the "F.A.R." (French) l.f. transformer for radio work.

ENGINEERING SUPPLIES, LTD., 155a, Upper Thames Street, E.C.4.—An illustrated price list of radio sets, components, and accessories.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A comprehensive catalogue of industrial lighting fittings, with technical data, illustrations, and prices.

MESSRS. F. & A. PARKINSON, LTD., Guisely, Leeds.—An illustrated brochure showing the application of the company's motors to various industries.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—A well-produced brochure dealing with various forms of chain drive with notes on the selection of chains. Full details of the firm's products are also given.

THE KARTRET SWITCHGEAR CO., LTD., S.W.1.—A fully illustrated and detailed catalogue of main switches and fuses, distribution boards, feeder pillars, and other switchgear.

MESSRS. RUSTON & HORNSBY, LTD., Lincoln.—A descriptive illustrated publication dealing with medium compression oil engines.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A batch of "Mazda" publicity matter in the form of cardboard "cut-outs," showcards, and pamphlets. One card contains useful information for users of electric lamps.

MESSRS. H. C. SLINGSBY, 89, 95 & 97, Kingsway, W.C.2.—An illustrated booklet dealing with the "Slingsby-Jacklift" truck.

Private Arrangements.—F. G. BARTLETT and S. BINNS, trading as Frank Bartlett & Co., 58, Merrion Street, Leeds, electrical and wireless engineers.—A meeting of the creditors of the above was held on August 19th at Leeds. The statement of affairs showed liabilities of £1,648, all due to trade creditors. The liabilities on bills discounted amounting to £750 were not expected to rank. The net assets totalled £739, or a deficiency of £889. It was reported that the business was commenced in August, 1922. From that date to February, 1923, the turnover was £2,211, on which a gross profit of £841 was made, and a net profit of £299. For the period from February, 1923, to December of the same year, the turnover was £2,650, while for the period from December last to August, 1924, the turnover was £2,294, the gross profit £611, and the net profit £458. It was stated that the present position had been brought about through depreciation of stock, and the deficiency was also accounted for by loss on trading, &c. After some discussion, it was resolved that the debtor should execute a deed of assignment to Mr. H. E. Harwood and Mr. C. H. Baker, accountant, of Leeds, as joint trustees with a committee of inspection. The following are creditors:—

	£		£
Lelios Lamp Co.	294	Burton, A. A.	52
Watshams, Ltd.	230	Cable Accessories Co., Ltd. ...	30
Tickle & Co., L. N.	203	Horsforth Garage	23
Accumulators (Birmingham), Ltd.	160	Dundas Fox	22
English Radio Co., Ltd.	70		

BARDELL'S, LTD., electrical engineers, Abbey House, Victoria Street, S.W.—In accordance with a circular letter issued by this company, a meeting of the creditors was held on August 20th, when the chair was taken by Mr. Bardell. The notice convening the meeting stated that it was hoped to put a scheme before the creditors and that the company had been badly hit by certain action which had recently taken place. Mr. Bardell stated that the claims of the unsecured creditors amounted to £600, while the assets were put down as of the value of £1,993. The assets were represented by 1,500 £1 ordinary shares in Bavistock, Ltd., and 130 preferred £1 shares in the same company, whose address was, or had been, the same as that of Bardell's, Ltd. There was also cash owing to Bardell's from Bavistock, Ltd., amounting to £113, and there was an estimated value of £250 set upon the lease of the premises at Abbey House over and above a sum of £500 for which the lease was mortgaged. Recently the landlords of the premises had distrained for rent, and further steps taken by them, which Mr. Bardell described in detail, resulted in Bardell's, Ltd., being practically evicted, while Bavistock, Ltd., was also seriously embarrassed by reason of having premises at the same address. Mr. Bardell stated that he believed that the creditors of Bardell's, Ltd., would be paid in full. It was really owing to the action of the landlords that the company was in the position in which it found itself.

Asked as to what the turnover of Bardell's, Ltd., was, Mr. Bardell said that he was unable to say, but the sales had not been large. The first mortgage on the lease was to Messrs. L. G. Hawkins & Co., Ltd.

Reference was made to the stock of the company which was recently sold at the instance of the landlords, and contained, so it was alleged, numerous wireless sets, electrical alabaster bowls, and other goods.

It was decided to appoint a committee, consisting of Mr. Houstoun, Mr. E. R. Livermore, and the representative of Messrs. Stanley Jones & Co., to confer with Mr. Bardell as to the position with a view to seeing whether some scheme could be formulated for the payment of the creditors' accounts.

The following are creditors:—

	£		£
Ancole & Turner, Ltd.	43	— Foster	26
Bower Electric, Ltd.	26	— Livermore	41
Berke Electrical Manufacturing Co., Ltd.	25	Perry & Co. (Bow), Ltd. ...	27
— Everett	46	Sun Electrical Co.	28
Electric Appliances Co., Ltd. ...	35	Stanley Jones & Co.	100

Book Notices.—"Handbook to the Exhibition of Pure Science," arranged by the Royal Society. Pp. 228. London: Messrs. A. & F. Denny, Ltd.; price 1s. net.—The exhibition of pure science forms part of the scheme of Government participation in the British Empire Exhibition; it was organised by the Royal Society and is housed in galleries 3 and 4 of the Government Pavilion at Wembley. This excellent handbook is arranged in two parts; the first is a series of 23 articles by well-known authors, intended to give some indication of the state of science at the time of the exhibition; the second is a well-written descriptive catalogue of the exhibits, numbered to correspond with the displays. It is a pity that the booklet did not appear earlier.

"Secrets of Mail Order Selling," by C. C. Freer. Pp. xi+229; figs. 63. London: The Library Press, Ltd. Price 15s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIII. No. 8. August, 1924. New York: The Institute. Price $1.

"Lehrbuch der Technischen Physik," by Dr. G. Gehlhoff. Pp. xii+386; figs. 248. Leipzig: J. A. Barth. Price G.M.17.50.

Electricity Supply Workers' Wages.—On Monday last the Ministry of Labour made the following announcement:—The difference between the two sides of the Joint Industrial Council for the electricity supply industry regarding the wages application has been referred to a special tribunal consisting of Mr. W. Addington Willis, C.B.E. (chairman), Alderman G. P. Dean, J.P., Mr. John Turner, Mr. W. B. Woodhouse, and Mr. Samuel Fedden. The secretary of the tribunal is Mr. A. J. Whitehead, M.B.E., Ministry of Labour, Montagu House, Whitehall. The tribunal will hold its first meeting at Whitehall Gardens, Whitehall, on Wednesday, August 27th.

Proposed New Dutch Tariff.—A full translation of the new Customs Tariff proposed by the Netherlands Government was issued as a supplement to last week's *Board of Trade Journal*. With but few exceptions the new Tariff provides for an imposition of 8 per cent. *ad valorem* on all imports including electrical and allied goods. Article 3 of the list provides that "for goods the rate of duty on which in the Tariff is dependent on the weight, and which on importation are provided with an electromotor, either built in or on or attached in a similar way, an addition of 5 kilograms will be made to the weight given in the Tariff as the limit of taxability."

Municipal Administration and Private Interests.—Further developments have arisen from the decision by Mr. Justice Bailhache, a short time ago, that a member of a local authority is disqualified from acting in that capacity if any firm of which he is a director secures a contract from the local authority concerned. The case was one which involved a Leeds alderman, and in our last issue we recorded the cancellation of a contract at Leigh to avoid the disqualification of an alderman. Last week Messrs. Jacob Long & Sons, Ltd., asked to be relieved of a contract for extensions to the Bath electricity works, costing about £29,600, owing to the fact that a member of the firm is an alderman of the City Corporation. Strangely enough, the next lowest tenderers for the contract were also unable to take it, for the same reason. Consequently the Council has been forced to accept a tender £4,000 higher than the lowest, which means the imposition of an extra 2½d. rate. In the same city the contract for the printing of the Council's minutes has been cancelled for similar reasons, and according to *The Times* an intensified state of affairs at Bristol and other places has led to the cancellation of several contracts, and the proposed resignation of directorships of companies.

Austrian Debt Claims.—The Administrator of Austrian Property has fixed September 15th as the last day for the receipt of proofs of debts due to British subjects by the Austrian Government or nationals for the payment of the fourth dividend. The address of the Administrator is Cornwall House, Stamford Street, E.C.1.

Lead.—Messrs. James Forster & Co., in their weekly letter, dated August 23rd, state:—"Closing prices yesterday were £32 16s. 3d. for August, and £32 2s. 6d. for November, against £33 and £32 5s., respectively, at the end of last week. There has been very little demand from consumers, who appear to be over-stocked by recent arrivals. Arrivals this month continue heavy, 17,000 tons being entered for London and Liverpool alone, according to the Customs Bill of Entry. It is surprising that the price is so well maintained, but values are little concerned with supply and demand, and are governed almost entirely for the moment by the speculative element. 2,000 tons of Mexican lead has arrived in London this week; for the first six months of this year Mexico supplied us with 1,215 tons of lead, against 6,785 tons to France in the same period."

British Empire Exhibition Note.—Within an hour of the opening of the Exhibition on August 21st the eleven millionth visitor passed through the turnstiles; thus, during the eight days ending on that date one million people attended the show. It was the 104th day of the Exhibition, the daily average number of visitors being 106,616.

For Sale.—The Agent-General for Tasmania, on behalf of the Government of Tasmania, is inviting offers for the purchase as a going concern of the assets of the Carbide Works at Electrona. Scunthorpe and Frodingham Urban District Council has for disposal 180 wooden poles, 30 ft. by 35 ft., 11 to 14 in. diameter (at present in use as electric light standards). For fuller particulars see our advertisement pages to-day.

The Italian Electrical Market.—According to statements published by the organ of the Association of the Italian Electrical Industry, the imports of electrotechnical articles into Italy in 1923 represented a value of about 100,000,000 lire, or an increase of 15,500,000 lire over the previous year; the value of the exports amounted to 63,000,000 lire, an advance of about the same amount. The imports last year were specially generators, transformers, and electrical apparatus for approximately 55,000,000 lire, this figure contrasting with exports of similar manufactures to the equivalent of 38,000,000 lire. The imports of meters largely increased, the total having been 270,000 in 1923 despite the fact that the duty on ordinary meters is from 9 to 12 gold lire per meter. The share of Germany in the Italian import trade last year is given at 75,000,000 lire. In the case of glow lamps, the imports, which reached 14,000,000 in 1922, declined to 12,600,000 last year, the inland lamp production having risen to 8,600,000. The imports of insulators, however, experienced an increase, the sources of origin being chiefly Germany and the United States, but the home production of insulators is making progress. The exports of cables and wire reached the value of 20,000,000 lire, which was in excess of the imports of similar manufactures. An expansion also took place last year in the exports of magnetos, which amounted to 2,800,000 lire, though the imports were greater at 3,200,000 lire. Concerning telephone, telegraph, and wireless apparatus, it is mentioned that the imports comprised about 25,000,000 lire, but the corresponding exports were inconsiderable. The consumption of electrodes has largely increased owing to the activity of the steel and electro-chemical industries, and is returned at 4,213 tons, or twice that of 1922. It is estimated that the value of the aggregate turnover in electrical manufactures in Italy last year reached 233,000,000 lire.

Municipal Electrical Contracting.—At a recent meeting of the electrical section of the Newcastle and Gateshead Chamber of Commerce the engagement by the Newcastle Corporation of direct labour for electrical wiring was criticised. It was stated that there were well-organised contracting firms in the district which could carry out the work at less cost to the ratepayers, and the secretary was directed to inquire into the matter and make a report to the Chamber.

Conditions in Japan.—A number of interesting and useful facts relating to Japan were placed before the recent Advertising Convention at Wembley by Sir E. T. F. Crowe, C.M.G., who until recently was our Commercial Counsellor at Tokio. Sir Edward Crowe pointed to the extraordinary growth of Japan's foreign trade in recent years—it has increased sevenfold since the beginning of the century—and the country's remarkable recuperative power. As an example of this Sir Edward instanced the rapid recovery from the effects of the recent disastrous earthquake. The country was a good market for electrical machinery, especially in the form of labour-saving appliances, for, contrary to the accepted idea, labour was not cheap in Japan. Attention was drawn to the wide circulations enjoyed by a number of newspapers; in Osaka, Sir Edward stated, there were two papers, each claiming a daily circulation of about a million copies. In this direction there was a great scope for reaching the consumer by suitable advertisements.

Norwegian Tariff Changes.—Among recent alterations in the Norwegian Customs Tariff, recorded in the *Board of Trade Journal*, are the following:—"Electric cables and wires, insulated, covered or not with plaiting, thread or the like: (i) Cables covered with pressed lead 0.10 kr. per kg. (formerly free); (ii) other kinds 0.35 kr. per kg. (formerly 0.50 kr.)." "Insulators of porcelain for high-tension current: 0.35 kr. per kg. (formerly 0.55 kr.)."

Copper and Lead Prices.—Messrs. F. Smith & Co. and Messrs. James & Shakespeare report August 26th:—No change in copper and lead prices.

The Engineering Industries in July.—The review of industry during July, which appears in the August *Ministry of Labour Gazette*, states that in the engineering trades generally depression continued, and the progressive tendency shown in recent months was not continued. Electrical engineering, however, "continued fairly good." There was an increase of 1.3 per cent. in the number of unemployed in the electrical wiring and contracting industry; in the electricity supply industry, and electric cable, wire, and electric lamp manufacturing industries unemployment remained at the same levels, *viz.*, 10 per cent. and 7.2 per cent., respectively.

"Lightning" Strike at Walthamstow.—A "lightning" strike of the employés of the Walthamstow Urban District Council occurred on August 20th, owing to a reduction made in their wages, and the electrical workers were involved. Upon the promise of the Council to give the matter further consideration the men returned to work. It is understood that the wages of the electricians are to remain at the present level until the national negotiations now in progress are settled.

Instrument Order Lost.—Last week Messrs. Crompton and Co., Ltd., Chelmsford, announced that they have recently lost to a foreign firm an important order for electrical instruments in spite of their efforts to quote prices low enough to secure the contract. Their inability to meet foreign competition is attributed to the withdrawal of the McKenna duties.

Trade Control in Occupied Germany.—The *Board of Trade Journal* states that it is anticipated that the control of trade in the Occupied Territory of Germany, consequent upon the application of the Dawes Report, will be transferred from the Franco-Belgian authorities to the German authorities by the following stages:—September 9th.—Abolition of the Customs barrier between Unoccupied Germany and the Occupied Territory of Germany. September 22nd (or earlier, if possible).—Franco-Belgian authorities in the Occupied Territory of Germany to apply the German Tariff instead of the Inter-Allied Tariff. October 22nd (or earlier, if possible).—Franco-Belgian authorities in the Occupied Territory to transfer the Customs administration and the control of imports and exports to the German authorities. The above is based on the assumption that the Reparation Commission is in a position to announce on September 1st that the necessary German laws for the application of the Dawes Scheme have been promulgated in the form approved by it, and that the Agent-General for Reparation Payments has taken up his duties.

Electricity in Tibet.—What is said to be the first electrical plant to be erected in Lhassa, the "Forbidden City," is being supplied by Messrs. Crompton & Co., Ltd., Chelmsford. The plant consists of a three-phase, 500-V alternator driven by a water turbine, and it is intended chiefly to supply power to the Government Mint in the city. Tibetan workmen have spent some time at Messrs. Crompton's works to study the erection of such plant, in order to enable outside assistance to be dispensed with.

State Support for Spanish Industry.—A scheme of State support in order to promote the establishment of industries in the country is being developed by the Spanish Directory. The scheme, which is to remain in operation for eight years and which extends to the electrical industry and to hydro-electric undertakings, sets forth as conditions for support, that 75 per cent. of the share capital must be held in Spain, that two-thirds of the directors and 80 per cent. of the employés must be of Spanish nationality. The utilisation of Spanish material is also specified, the use of foreign goods being only permitted when the home supply is insufficient or when the cost of the latter exceeds by more than 15 per cent. that of imported material.

British Trade Mark Applications.—The following are among the recent applications for British trade-marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the name and address of the British representative are also given.

Canning. No. 449,100. Class 18. Complete plants or equipments for use in plating, enamelling, japanning, and drying operations.—W. Canning & Co., Ltd., 133-137, Great Hampton Street, Birmingham. August 20th, 1924.

Sacam (lettering and design). No. 449,108. Class 18. Electrical ventilating apparatus.—La Société Chauffage au Mazout, 92, Boulevard Emile Jaquemain, Brussels. (L. N. Reddie, 1, Furnival Street, Holborn, London, E.C.4.) August 20th, 1924.

C.S. Radio (lettering and design). No. 445,387. Class 8. Philosophical instruments and apparatus for useful purposes, &c.—Cunningham Slater, Ltd., 146, Kensington High Street, London, W.8. August 20th, 1924.

Sensitite. No. 449,646. Class 8. Crystal for detecting wireless waves.—Lionel Solomon Alexander, trading as the Wholesale Wireless Co., 103, Farringdon Road, London, E.C.1. August 20th, 1924.

Gillophone. No. 447,437. Class 8. Instruments and apparatus for use in wireless signalling.—John Thomas Gillott, 17, St. Peter's Gate, Nottingham. August 20th, 1924.

Daimon (lettering and design). No. 448,787. Class 8. Electric batteries, not for medical purposes.—Julius Toubkin Chalimar, Holland Road, Crumpsall, Manchester. August 20th, 1924.

Austrian Water-power Development.—According to reports in the evening papers, a group of American bankers has agreed to make a loan of $3,000,000 to the Lower Austrian Electrical Company for the installation of water-power plant. The company already has nine power stations working with a capacity of 10,880 kilowatts and three more in the course of construction of a capacity of 5,500 kilowatts. The American loan would ensure the completion of the Lower Austrian Waterworks.—*Reuter* (Vienna).

New French Company.—A new company has lately been formed in Paris (6, Rue de Maubeuge), with a capital of one million francs and the title La Société de l'Energie Electrique Oleronnaise, to acquire and carry on the electrical engineering business of Chaignaud and Parendéaud.

Unemployment.—The number of persons registered as totally unemployed again increased during the week ended August 11th, the figure being 1,091,700 as compared with 1,080,500 a week earlier. The reduction in the total since the beginning of the year now stands at 193,900.

Pulverised Fuel Contracts.—VICKERS & INTERNATIONAL COMBUSTION ENGINEERING, LTD., has received an order for a complete pulverised fuel installation for the municipal power station, Derby. The plant will consist of two Babcock & Wilcox water-tube boilers to give steam at 300 lb. per sq. in. superheated to 750 deg. F., each boiler having a patent Lopulco combustion chamber with patent water screen and passages inside the walls for pre-heating air; a dryer of the improved Lopulco type which will reduce the moisture in the fuel to about 5 per cent.; two Raymond roller pulverisers, each having six rollers to grind the fuel to such fineness that 90 per cent. will pass through a 100-mesh sieve, each machine being complete with fan and cyclone; a screw conveyor to deliver pulverised fuel from the cyclones to the boiler bunkers; two groups of Lopulco feeders, each with five screws for delivering the pulverised fuel to the burners, operated by variable-speed electric motors; and 10 Lopulco burners of the flat flame type with primary air ports designed to rest on the suspended arches of the combustion chambers.

The International Combustion Engineering Corporation, of New York, an associated company, received the following orders for Lopulco equipment during the month of June:—Narragansett Electric Lighting Co., with six boilers. St. Joseph Lead Co., Rivermines, with two 1,000-h.p. Heine boilers. Alleghany Steel Co., Pittsburg, with two 760-h.p. Stirling boilers.

Swedish Electrical Dispute.—Negotiations in connection with the electrical fitters' dispute ended in a deadlock on August 21st. *Folkets Dagblad* states that the electricians at Gothenburg have also asked for an increase in wages, but the employers have refused to discuss the matter. Moreover, an increase has also been demanded at Malmoe.—*Reuter's Trade Service* (Stockholm).

Foreign Competition in Holland.—The annual report of the Hengelo Electrical and Mechanical Apparatus Works Co. complains of the competition of countries with a depreciated currency and of the lack of orders from the Governments of Holland and the Netherlands East Indies. Although the company succeeded in increasing its exports in 1923-24 by 40 per cent., the report states that the export trade is hampered by the import difficulties raised by other countries. In Holland motors can still be imported free of duty, the 5 per cent. duty on apparatus, transformers, and measuring instruments is being abolished, but cables are to be subject to a duty of 8 per cent. On the other hand, an import veto on the manufactures made by the company exists in Germany, while the prices of first-class products there are from 15 to 30 per cent. higher than those in Holland. The result is that owing to the exclusion of foreign competition in Germany, the German firms are able to obtain such high prices at home as to be able to undersell other countries, including Holland, in their home markets.

Electricity Supply in Luxemburg.—It is stated that no definite information has become available concerning the tenders which were submitted by various foreign firms some months ago for the establishment of electricity supply works in Luxemburg. In the meantime a Luxemburg newspaper announces that the A.E.G. of Berlin, in conjunction with its subsidiary (Solpée) in Luxemburg and the Bitburg authorities, has prepared a scheme for the utilisation of the water power of the Luxemburg-German frontier river Our and its tributaries by the erection of several dams.

Lighting and Power Notes.

Adwick-le-Street.—ELECTRICITY SUPPLY.—A Special Order has been granted by the Electricity Commissioners to the Urban Council to purchase and distribute electricity in bulk from the Brodsworth Colliery. It is expected that the charge to consumers will be at a lower rate than charged at Doncaster and other places in the district. The whole of the colliery houses, which form the majority of dwellings in the district, will be supplied.

Argentina.—WATER-POWER CONCESSION.—It is reported from Buenos Aires that the Compania Hispano Americano has taken over a concession granted some time ago to a French engineer to utilise the water power of the River Uruguay near Salto Grande. It is stated that about 180,000 h.p. is available.

Biggleswade.—ELECTRICITY SUPPLY.—The Rural District Council has decided to support the application of the First Garden City, Ltd., to the Electricity Commissioners for a Special Order authorising the company to supply electricity to certain parishes within the rural district of Biggleswade.

Bradford.—PROPOSED PRICE REDUCTION.—The Electricity Committee has recommended a reduction in the charges for the supply of electricity, which, if approved by the Council, will operate from July 1st; the basic charge to domestic consumers under the recommendation will be 17½ per cent. of the present-day rateable value in place of 25 per cent., as at present. The price per kWh will remain at a penny, but consumers of more than 10 units per £ of their rateable value in the half-year will be charged ½d. per kWh for any additional supply. The maximum rate charged to power consumers will be reduced from 3½d. to 3d.

NEW PLANT.—The Electricity Committee has decided to install additional plant at the Valley Road generating station at a cost of £50,000.

Brecon.—ELECTRICITY SUPPLY.—The Town Council has accepted the offer of Messrs. Arthur Ellis, of Cardiff, to prepare a report as to how an electricity supply can be most suitably established in the borough at a nominal fee of 25 guineas.

Continental.—SPAIN.—*Hydro-Electric Power.*—A hydro-electric plant has recently been completed to supply electricity for lighting and power purposes at the paper mills of the Sociédad Portu Hermanos y Cia at Villabona, province of Guipuzcoa. The plant utilises the water power of the Lizarasola Falls, about three miles from the mills, the current being transmitted at 3,500 V and stepped down to 500 V. The turbines were supplied by the Société des Ateliers de Constructions Mécaniques, of Vevey, Switzerland, and the electrical plant by the Siemens-Schuckert Co., of Berlin.

FRANCE.—*Standardisation.*—Good progress is being made with the work of standardising the current supply in the Paris district to a.c. at 50 cycles per second. The task has been anything but an easy one, as until quite recently the different stations were supplying current at 25, 42, 50, and 53.33 cycles.

Hydro-Electric Power.—Water power to the extent of 2,400,000 h.p. is at present utilised in France. Of the total, 2,250,000 h.p. is employed in the generation of electrical energy, 850,000 h.p. of which, or about 3.7 per cent., is utilised in connection with electro-metallurgical and electro-chemical industries.

Railway Electrification.—Work is in hand by the Compagnie des Chemins de Fer du Midi on the electrification of the railway between Bedous and the Spanish Frontier on the section between Bedous and Canfranc. The three-phase, 50-period current will be transmitted at 60,000 V to three sub-stations, where it will be stepped down to 1,500 V d.c. The two extreme stations will be equipped with three, and the central one with two, converters each of 750-kW capacity. One of the sub-stations will also be connected up to the 60,000-V transmission line from the power station of the Société des Forces Motrices de la Valle d'Aspi.

POLAND.—A company has lately been formed in Riga with the title "Strawa," to establish a plant to utilise the water power of the River Duria at Dahlenhom, for the generation of electrical energy.

Corsham.—ELECTRICITY ORDER.—The Electricity Commissioners have granted an order for the supply of electricity in the district, to the Western Electric Distribution Corporation.

Darlington.—EXTENSION OF SUPPLY AREA.—The Corporation has decided that pending the receipt of powers to supply electricity in Croft and Hurworth districts, the borough electrical engineer shall extend the cable to as far as the borough boundary.

East Grinstead.—LOAN.—The Urban Council has applied to the Electricity Commissioners for sanction to a loan of £7,122 for electricity extensions.

Gravesend.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £15,000 for mains and house service connections.

Greenock.—YEAR'S WORKING.—The accounts of the Electricity Department for the past year show a deficit of £38,074, which the Committee recommends should be taken from the reserve fund, which stands at £61,174.

Hexham.—STREET LIGHTING.—At a meeting of the Urban Council on August 18th, held to consider the question of street lighting, two proposals were before the meeting. Hexham Gas Co. offered to light the whole of the streets lighted by gas at present for £2 15s. per lamp inclusive of maintenance. Hexham & District Electric Lighting Co. offered to light 74 lamps at £2 10s. per 60-watt lamp, and £2 15s. per 75-watt lamp per annum, the agreement to cover five years. After discussion it was agreed to accept the Electric Lighting Co.'s offer, but to ask it to make a three years instead of a five years' agreement.

Heywood.—LOAN SANCTION.—The Electricity Committee has received the sanction of the Electricity Commissioners to borrow £9,627 for new extensions for a bulk supply.

MAINS.—The Committee has decided to lay another main from Bury to provide an alternative route for the bulk supply of electricity which it obtains from Bury Corporation.

Hutton, near Brentwood.—FIRE.—On Monday last week a shed at the Hutton electricity station was found to be on fire. The shed contained a tank with 10 tons of oil for the engines at the generating station, and the flames were carried to one side of the buildings of the electricity station, which were in some danger. Owing to difficulties of access, the Brentwood fire engine was unable to get near for some time, and hand pumps and buckets had to be brought into use. After some hours the outbreak was got under control.

Kettering.—YEAR'S WORKING.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. W. A. Walker) for the year ended March 31st last show a total revenue of £37,592, as compared with £36,355 in the preceding year. The working expenditure was £19,807, as against £19,435, leaving a gross revenue of £17,785 (£16,820). Capital charges were slightly higher, but the net profit at £5,033 represented an increase of about £600. This surplus was added to £13,601 brought forward, and £1,066 was contributed to rate relief, £5,000 transferred to reserve, and £2,847 spent on capital purposes. A sum of £14,383 was spent on capital account, of which cables took £9,424 and machinery £2,027. The energy sold increased from 3,600,497 to 3,932,134 kWh.

Lichfield.—ELECTRICITY ORDER.—The City Council is applying to the Electricity Commissioners for authority to purchase electricity in bulk from the Walsall Corporation for distribution in the city and surrounding district.

Littleborough.—GRANT.—The Unemployment Grants Committee has sanctioned a grant of 65 per cent. of the interest and sinking fund charges for half the period of the loans, in connection with the provision of electricity cables and lamp connections for lighting the main road between Steanor Bottoms and Wardle Street.

London.—STEPNEY.—We have received from Mr. W. C. P. Tapper, borough electrical engineer, a copy of his report, together with the accounts, of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £261,283, the expenditure to £148,373, and the gross profit £112,910. The corresponding figures for the previous year were £278,807, £141,741, and £137,066, respectively. The addition of other receipts to the gross surplus rendered a sum of £116,732 available (£138,358), and against this were debited capital charges, &c., totalling £77,997, leaving a net balance, carried to the appropriation account, of £38,736, as compared with £65,645 in 1922-23. £28,000 of the balance was contributed to rate relief, and £4,691 was transferred to the reserves for insurance and renewals and contingencies. A sum of £214,920 was spent on capital account during the year; this included the following items:—Machinery, £112,550; buildings, £42,293; and mains and services, £51,116. The amount of energy sold increased from 34,418,923 to 42,140,142 kWh; the maximum simultaneous load rose from 16,710 to 10,070 kW; and the plant capacity was 8,500 kW greater at 32,000 kW. During the year charges to consumers were substantially reduced, and meter rentals, &c., were abolished.

New Zealand.—NEW STATION.—The Evans Bay power station, on the outskirts of the city of Wellington, has been inaugurated. The plant generates alternating current at 11,000 V, which is transmitted to the Jervois Quay sub-station in the city, where part is converted to 550 V direct current for the tramway service and for the d.c. portion of the industrial load. To supply the a.c. load (lighting and a portion of the motor load) the supply has to be stepped down to 110 V, which is the present supply voltage. A further change is necessary, however, as the 50 cycles of the new plant does not agree with the 80 cycles forming the present standard of frequency in Wellington to suit the city street transformers and a.c. motors. One frequency changer is at present in operation, and another one is expected to be delivered shortly. This second machine will deal with current from the Mangahao hydro-electric station when the latter is completed.

A recent official report shows that at the end of the last fiscal year there were 31 hydro-electric stations in New Zealand, with 60,000 consumers, and an average capacity of 938 kW; nine steam stations, with an average capacity of 2,658 kW, supplied 33,562 consumers; while 21 gas-operated stations, with an average capacity of 166 kW, supplied 10,132, and two oil stations, average capacity 393 kW, supplied 3,059 consumers. The total revenue for the year was £1,082,748, equalling 1.91d. per kWh sold.

Oldham.—YEAR'S WORKING.—The revenue of the electricity undertaking (engineer: Mr. F. L. Ogden) during the year ended March 31st last amounted to £205,439, as compared with £188,184 in the preceding year. The working expenditure was £113,130, as against £101,770, leaving a gross profit of £92,309 (£86,414). To this was added a balance of £23,149 from the last account (as compared with £1,403), and £8,180 representing income tax deducted from loan interest, making £123,638 (£96,150). Capital charges were considerably higher, £104,682, as against £73,002, reducing the net balance carried forward from £23,149 to £18,956. The charges included the following items:—Amount transferred to reserve, £13,149; amount transferred to plant insurance fund, £10,000: and amount disallowed by the Electricity Commissioners on new plant, £9,477. A total of £107,171 was spent on capital account during the year; buildings, machinery and plant cost £53,028, and street mains £40,250. The amount of energy sold rose from 29,832,893 to 34,576,979 kWh, and the maximum demand upon the 26,000 kW of plant (excluding traction) was 17,834 kW, as against 15,200 kW. The maximum demand for traction was 1,650 kW.

Penmaenmawr.—ELECTRICITY SUPPLY SCHEME.—The Council last week adopted tenders amounting to £12,796 in connection with the electricity scheme for the whole of Penmaenmawr, including Capelulo. Application is to be made to the Electricity Commissioners to sanction the borrowing of this amount.

Peterborough.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. A. Nevill) for the year ended March 31st last record a total revenue of £40,370, as compared with £32,828, and a working expenditure of £20,985, as against £19,989, leaving a gross surplus of £19,387 (£12,839). As in the previous year this balance was insufficient to meet the capital charges, and the result was a deficit of £4,561, as compared with £5,726. Other charges made against revenue increased this deficit to £5,664. The amount of energy sold was 4,273,955 kWh.

Preston.—SPECIAL ORDER.—The Town Council is recommended to approve an application to the Electricity Commissioners for an Order authorising it to generate, supply, and distribute electricity to various outlying districts, including Leyland, Walton-le-Dale, Longton, Cuerden, and Clayton-le-Woods.

Price Reduction.—HASLINGDEN.—Private lighting: From 6d. to 5½d. per kWh. Private heating: From 1½d. to 1¼d. per kWh. Tramways: 1¾d. to 1¼d., with reductions to large power consumers.

Radcliffe.—CONVERTING PLANT.—The District Council has approved of the purchase of a 700-kVA rotary converter, and it is hoped to have the machine installed in readiness for the winter load.

Radstock.—SPECIAL ORDER.—The Urban District Council has decided to offer no opposition to the application of the North Somerset Electric Supply Co. to the Electricity Commissioners for authority to supply electricity in certain portions of North Somerset.

Richmond (Yorks.).—MILITARY ELECTRICITY SUPPLY.—The Town Council has decided to give permission to the military authorities to lay an underground cable from Catterick to the barracks, subject to their undertaking not to supply electrical energy for private purposes within the borough.

Rye.—ELECTRICITY SCHEME.—The Town Council has granted an extension of option of three months to Crompton & Co., Ltd., who report that they now have greater hopes for a supply of electricity for the borough.

Sheffield.—YEAR'S WORKING.—The accounts for the year ended March 31st last of the municipal electricity supply undertaking (general manager and engineer: Mr. S. E. Fedden) record a gross revenue of £806,763, and a working expenditure of £297,730, leaving a surplus of £509,033. In the preceding year the revenue was £763,715 and the expenditure £288,338, making the gross profit £475,377. Although the amount charged against the surplus was some £6,000 greater, the net result was an increase in profit from £173,828 to £201,351. To this was added a balance of £60 from the installation and motor account, and the balance of income

tax provision, £15,147, making a total of £216,828. This was dealt with as follows:—To rate relief, £45,416; to renewals and special expenditure fund, £120,000; and to reserve fund, £51,411. The renewals, &c., fund has a balance of £198,024, and the reserve fund a balance of £137,818. The capital expenditure during the year amounted to £62,542, bringing the total up to £3,866,485. The largest single item of expenditure was £48,194 for mains. The energy sold represented a good increase, amounting to 151,896,004 kWh, as compared with 123,498,177 kWh in 1922-23. The connected load rose from 212,190 to 218,641 kW, and the maximum demand from 64,166 to 72,487 kVA. The plant capacity remained at 98,500 kW. Charges were reduced during the year, and effected a saving to consumers of £125,000. There was a considerable reduction in the receipts per kWh sold, the figure being 1.269d., as against 1.655d.

Slaithwaite.—SCALE OF CHARGES.—The District Council has approved of the following scale of charges to consumers in connection with the supply of alternating current at 50 cycles 400 V for power and 250 V for lighting:—Lighting, 7d. per kWh; heating, 2d. per kWh; domestic rate, 15s. per room plus 2d. per kWh; small power users up to 20 b.h.p., four guineas per annum, or 21s. per year per b.h.p. of motors installed.

South Africa.—JOHANNESBURG.—*Witbank Station.*—Tenders have now been called by the Electricity Supply Commission for a generating station of 60,000-kW capacity at Witbank. With coal available at the extremely low price of 1s. 9d. per ton, the station may be expected to provide the cheapest steam-generated power in the world. When the Witbank station comes into operation it is estimated that it will be possible to deliver power to the mines at .44d. per kWh. This notwithstanding, the Johannesburg Municipality is still seriously divided between the idea of participating in the new supply and an intention to spend half a million sterling on extending a local power station to which every ton of coal has to be railed at great expense, and where an expensive staff has to be kept in order to supply half the amount of current used by any one of the big groups of mines.—*S.A. Mining and Engineering Journal.*

Southampton.—EXTENSION OF AREA.—The Corporation is considering the expediency of applying to the Electricity Commissioners for an order authorising the Council to supply electricity within the parishes of Botley, Bursledon, Chilworth, Hamble, Hedge End, Hound and Millbrook, and a portion of the parish of West End.

Taunton.—SPECIAL ORDER.—The Town Council is applying to the Electricity Commissioners for a special order authorising it to supply electricity within the area of the Rural Council.

Teignmouth.—SPECIAL ORDER.—The Teignmouth Electric Lighting Co., Ltd., is applying to the Electricity Commissioners for authority to extend its area of supply of electricity to include Bishop's Teignton, Bovey Tracey, Haccombe-with-Combe, Hennock, Ideford, King's Teignton, Stoke-in-Teignhead, Teigngrace, and Trusham.

Wirral.—ELECTRICITY INQUIRY.—A Birkenhead paper states that the Electricity Commissioners will hold a local inquiry in September in connection with the proposal for the supply of electricity in Wirral, Neston and Parkgate.

Wrexham.—ELECTRICITY SUPPLY SCHEME.—The Rural District Council has decided to obtain from the supply company the terms on which it would undertake the distribution of electricity.

Yarmouth.—EXPERT'S REPORT.—The General Purposes Committee has adopted the report of the consulting engineer, Mr. J. H. Rider, on the Council's electricity undertaking. The report recommends that the whole of the transmission, transforming, and distribution system should be converted, section by section, to 3-phase, 50 cycles; that all lighting consumers should be supplied at 200 V with single-phase current at 50 cycles from 3-phase 4-wire distribution mains; and all power consumers at 345 V with 3-phase current at 50 cycles. Consideration of the remainder of the recommendations in Mr. Rider's report was adjourned pending a conference between Lowestoft, Norwich, and Yarmouth Corporations on the supply of electricity in bulk.

Tramway and Railway Notes.

Belgian Congo.—RAILWAY ELECTRIFICATION.—It was announced in the Belgian Parliament recently that an arrangement had been concluded between the Ministry of the Colonies and the Congo Railway Co. to send out a technical commission to study the problem of utilising the water-power resources of the Belgian Congo and particularly of the Congo River and the Inkissi Falls, in connection with the projected electrification of the Matadi-Leopoldville railway. Pending the report of the commission, it has been decided to proceed with the reconstruction of the line from Kilometre 40 as far as Leopoldville and to establish a small central station—either a hydro-electric plant on the River N'Pozo or a steam-operated installation at Matadi—to provide current for the working of the difficult portion of the railway between Matadi and Kilometre 40.

Brazil.—RAILWAY ELECTRIFICATION.—The narrow-gauge railway across the island of Santo Amaro, off the coast of Brazil, belonging to the Companhia Guarirja, is being electrified.

Ipswich.—RAILLESS TRACTION.—The Electric Supply and Tramways Committee recommends that the Wherstead Road section of the Corporation tramways be converted to the railless trolley system, and that an additional railless vehicle be purchased at a cost of £1,500; the cost of the necessary alteration to the overhead equipment is estimated at £600.

London.—TUBE DEVELOPMENTS.—Although it was only at the end of last year that Parliamentary sanction was obtained for the Clapham to Morden extension of the City and South London Railway, the preliminary engineering operations in the way of sinking working shafts at the sites of the new stations has proceeded so rapidly that the task of boring the tunnels has just begun. This work will be carried out contemporaneously from seven points, and will proceed day and night. About 100 ft. of double tunnel will be constructed weekly from each working, giving a total of 1,400 ft. of tunnelling per week. It is expected to have the line opened for traffic by December, 1925. By that time the extensions of the Hampstead tube to Kennington will, it is hoped, be completed, so that it will then be practicable to work a through service between Morden and Edgware, *via* Kennington and Charing Cross, in addition to the one by way of the reconditioned City and South London line and the Camden Town junctions.

Sheffield.—MOTOR-'BUSES.—The Tramways Committee has decided to substitute motor-'buses for trams on one of its routes. It is estimated that to renew and extend the track would cost £25,150, as compared with £11,800 for the provision of seven 'buses and removing the existing track.

South Africa.—CAPE TOWN RAILWAY ELECTRIFICATION.—The South African Railway Board recommends that the electrification of the Cape Town-Simonstown, Monument Docks, and Monument-Sea Point lines be proceeded with during the financial year 1924-25; and that provision for this purpose be made in the estimates for £759,375.—*South African.*

Swansea.—LIGHT RAILWAY ELECTRIFICATION.—The Swansea Improvements and Tramways Committee is applying to the Minister of Transport for an Order under the Railways (Electrical Power) Act, 1903, authorising the company to electrify the Oystermouth railway or tramroad and the Mumbles railway.

Uruguay.—TRAMWAY ELECTRIFICATION.—It is announced from Montevideo that the National Administrative Council of Uruguay has definitely approved the proposal for the electrification of the system of the Northern Tramway Co. It is stated that tenders will be invited for both the construction and the financing of the work.

Telegraph and Telephone Notes.

Belgium.—AUTOMATIC TELEPHONY.—The third automatic telephone exchange in Belgium is about to be opened at Schaerbeek, Brussels. The system installed is that of the Western Electric Co., Ltd.

Denmark.—RADIO AT SEA.—The Dansk-Radio Corporation, in its annual report for 1923, states that the use of wireless equipment in the Danish merchant marine is constantly increasing. At the close of 1923 there were 201 ships equipped with wireless, as compared with 184 at the close of the previous year. A station is to be erected at Gilleleje, a small town on the north of the island of Zealand, so that vessels in the Kattegat will be able to ask for and receive directions as to their position. If this station proves successful, it is planned to erect similar stations at a number of places along the Danish coasts.—*Commerce Reports.*

Empire Radio Communication.—AUSTRALIAN BILL.—Mr. Bruce has introduced a Bill into the House of Representatives authorising amendments to the agreement between the Commonwealth Government and the Amalgamated Wireless Co. in consequence of recent developments. As a result of the British Government's refusal to license the Marconi Co., the new agreement relieves the Amalgamated Co. of its obligations under the previous agreement to erect and operate stations in England and Canada, and confines the work to Australia. The company undertakes to erect stations capable of communicating direct with Canada and the United Kingdom, with a minimum capacity of 21,600 words daily in both directions, 300 days annually.—*Daily Telegraph.*

In the House of Representatives on August 22nd, the Prime Minister, speaking on the second reading of the Wireless Agreement Bill, said that instead of a high-power station, a "beam" station would be erected in Australia, costing £120,000, and operating on a wave-length of 100 metres. Mr. Bruce added that it was hoped the transmission rates would be half those chargeable under the high-power system.—*Reuter.*

Greece.—Automatic Telephony.—It is reported that an English firm has signed a contract for the installation of automatic telephone systems in Athens, The Piraeus, Salonica, and Patras.

India.—Meteorological Service.—The India Meteorological Department at Alipore has lately inaugurated a special daily weather summary service for the benefit of subscribers to the Indian telephone system.

Radio at Sea.—New Rules.—New rules relating to the life-saving appliances to be carried on board ship have been made by the Board of Trade and laid before Parliament. They are to come into force on July 1st, 1925. The principal points in which these new rules differ from those at present in force are the following:—The carriage of a motor-boat or boats is made compulsory on vessels carrying more than 15 lifeboats, and these motor-boats must be fitted with wireless apparatus. If the vessel does not carry a motor-boat and has more than ten lifeboats, one of these must be fitted with wireless.

The Telephone Service.—New England-Holland Cable.—The Hague correspondent of *The Times* reports that the British cable ship *Fareway* started laying a second telephone cable between England and Holland on August 22nd.

Radio Notes.

Germany.—Broadcasting.—The Berlin station is now transmitting a service of commercial news daily, and is arranging to broadcast advertisements. It is further proposed to permit the broadcasting of personal messages. These will be confined at first to messages of good wishes, but the regulations concerning their transmission have not yet been completed.—*Evening News.*

Japan.—Broadcasting Plans.—Plans are reported to be under way for the formation by the Mitsui, Takata, and other interests of a Metropolitan Broadcasting Co., which will be licensed by the Department of Officials for broadcasting in the Tokyo area. The new company will be capitalised at 2,000,000 yen, one quarter paid up, and is expected to start operations early next year. Subscribers to its service may either purchase or lease their receiving sets. The company's radius will be 100 miles only, it being the intention of the authorities to license other concerns for broadcasting in other areas.—*Financial Times.*

Municipal Broadcasting.—First Two Stations.—The first municipal radio station has been installed in the Municipal Building, New York, at a cost of approximately £10,000. It is proposed to send out popular concerts and to attract a regular audience which can be informed of civic news and events. The city of Durban, South Africa, is also going to have a municipal station.

Relay Stations.—Four New Ones.—It is understood that a new relay broadcasting station is to be opened at Nottingham about September 16th; another at Stoke-on-Trent early in October; one at Dundee in November; and one at Swansea in December.

Sweden.—Broadcasting Stations.—The Telegrafstyrelsen (Telegraph Board) is requesting the Government's authorisation to erect broadcasting stations at Stockholm, Gothenburg, Malmoe, Sundsvall, and Boden, and to conclude an agreement with Aktiebolaget Radiojaenst regarding the management of broadcasting.—*Reuter's Trade Service* (Stockholm).

United States.—Proposed Receiver Tax.—The National Association of Radio Broadcasters has issued a statement declaring that broadcasting cannot continue on the present basis, and announcing a plan to stabilise programmes by paying the artistes. This Association, which includes practically all the important stations in the United States, would compel the stamping of all radio parts, based on ½ per cent. of the retail price. It is estimated that this would yield £300,000 yearly with which to pay the artistes.—*Evening News.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—Buenos Aires.—October 27th. Ministry of Public Works. 25 steam travelling cranes and 1 stationary electric crane.*

Australia.—Brisbane.—September 1st. City Electric Light Co. 150,000-V testing transformer.

Bedford.—September 3rd. Electricity Department. E.h.p. and other transformers. (August 15th.)

Belfast.—September 8th. Electricity Department. One electrically-driven passenger lift. Specifications from Mr. Johnstone Wright, city electrical engineer.

Belgium.—September 17th. The Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Supply and laying of underground electric cables required in connection with the electrification of the Brussels-Humbeck line. Copies of the specification for 3 fr.

Bolton.—September 6th. Board of Guardians. Electric lighting installations at Fishpool Institution, the Hollins Cottage Homes, and the Townleys House, Farnworth. Specifications from Mr. John Ward, architect to Board of Guardians, 24, Mawdsley Street, Bolton.

Canada.—Toronto.—September 16th. City Council. One 40 million-gallon centrifugal pump and electric motor, or two 20 million-gallon pumps and motors.*

China.—The Kiaochow Tsinanfu Railway. 1,700 metric tons of 43 kilogram rails, 100 metric tons of fishplates, 10 metric tons of bolts and nuts.—*Reuter's Trade Service* (Shanghai).

Czecho-Slovakia.—Prague.—October 21st. State Railways. Electric locomotives and materials in connection with the electrification scheme. (Ref. A X 1,261).*

Dundee.—September 8th. Water Commissioners. Rewiring offices at 93 and 95, Commercial Street. Specification, &c., from Mr. George Baxter, Junr., engineer and manager.

Edinburgh.—August 30th. Tramways Department. Six complete top-covered car bodies. Specifications from the tramway manager, 2, St. James's Square, Edinburgh.

September 8th. Electrically-driven pumps, with switchgear, &c., and an electric locomotive grab crane, &c. (August 22nd.)

Egypt.—Cairo.—October 1st. Egyptian State Railways. 500 wall telephones. Specification from the Stores Department, Saptia (Cairo), or Gabbary (Alexandria). Simultaneous offers will be received at the Inspecting Engineer's office in London.—*Reuter's Trade Service* (Cairo).

Faversham.—September 1st. Electricity Department. Rearrangement of the existing switchboard and supply and installation of new switchgear. (August 15th.)

September 6th. Electricity Department. Water cooling tower, motor-driven centrifugal pumps, and centrifugal oil purifier. (August 22nd.)

Govan.—The District Board of Control invites tenders for electric lighting installations in houses at Hawkhead Asylum, Crookston. Schedules from Mr. Angus Baillie, acting clerk, 7-8, Carlton Place, Glasgow.

Haslingden.—September 5th. Haslingden, Rawtenstall, and Bacup Outfall Sewerage Board. Alterations and additions to machinery. (August 15th.)

India.—September 1st. Madras Corporation. Five miles twin 7/.048 and two miles twin 7/.064 paper-insulated, lead-covered and steel tape armoured cable suitable for pressures up to 660 V a.c.

London.—H.M. Office of Works.—September 2nd. 150-kVA motor alternator set, &c., at the National Physical Laboratory. H.M. Office of Works (Contracts Branch), King Charles Street, London, S.W.1.

Holborn.—September 10th. Board of Guardians. Six months' supply of electrical fittings, &c. Mr. C. J. Cross, clerk to the Guardians, 53, Clerkenwell Road, E.C.

New Zealand.—Taranaki.—October 7th. Electric Power Board. Transformers. (Contract No. 43.)*

Wairere.—Electric Power Board. October 7th. Small hydro-electric plant.*

Redditch.—Installation of electric lighting at Aspinal Gorton Wesleyan Methodist Church and schools. Secretary, 52, Station Road, Redditch.

South Africa.—Johannesburg.—September 8th. Electricity Supply Commission. Establishment and working of an undertaking in the Witbank district of the Transvaal Province for the supply of electricity to the Victoria Falls and Transvaal Power Co., Ltd., and consumers within a 15-mile radius of the proposed generating station. The undertaking is to include, in the first instance, a generating station of 60,000-kW capacity. Tender forms (£10 10s.) and particulars from the Electricity Supply Commission, 82, Marshall Street, Johannesburg.

September 15th. South African Railways and Harbours. Electric cables and wires for 12 months. Incandescent electric lamps.*

Stellenbosch (Cape Province).—September 5th. Municipal Council. Complete electric lighting and generating plant.*

Warrington.—September 1st. Electricity Department. Twelve months' supply of earthenware conduits. (August 15th.)

September 16th. Electricity and Tramways Committee. H. and l.p. paper and lead-covered cable. (See this issue.)

West Ham.—September 8th. Tramways Department. Six double-deck electric tramcar bodies, with totally-enclosed roof covers; 6 car sets of centre-bearing swing bolster trucks. Mr. L. Slattery, general manager, Greengate Street, Plaistow, E.13.

Workington.—September 13th. Corporation h.p. and l.p. cable, h.p. and l.p. switchgear, including erection, and 100-kVA transformer. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belfast.—Tramways Committee. Reconstruction and new construction work on the permanent way (re-advertised tenders):—

N. A. Boswell	£189,220
J. Graham (Recommended)	**185,771**
J. Hogg	187,597
F. B. McKee	186,785
Stewart Partners	189,888

The tender of Mr. J. Graham at £185,771 for reconstruction and construction work was recommended by the committee, with £190,000 for maintenance during the five subsequent years after completion.

Cardiff.—
Electric lighting and power installation in the Great Western Railway warehouses at Cardiff Docks.—Page & Stibb.

Derby.—LONDON, MIDLAND & SCOTTISH RAILWAY. Accepted:
Cosmos train-lighting lamps.—Metro-Vick Supplies, Ltd.
Vacuum train-lighting lamps.—Siemens & English Electric Lamp Co., Ltd.

Government Contracts.—The following Government contracts were placed during July, 1924:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.
Air compressors.—P. Brotherhood, Ltd.
Ammeters and voltmeters.—Everett, Edgcumbe & Co., Ltd.
Brass and copper sheets, bars, &c.—British Insulated & Helsby Cables, Ltd.; Delta Metal Co., Ltd.; Elliott's Metal Co., Ltd.; Muntz Metal Co., Ltd.; P. H. Muntz & Co., Ltd.; Vivian & Sons, Ltd.; Williams, Foster & Co., Ltd.; Pascoe, Grenfell & Sons, Ltd.
Conduit fittings.—General Electric Co., Ltd.; Barton & Sons, Ltd.; H. R. Bloor & Co.; Credenda Conduits Co., Ltd.; Eureka Conduits and Fittings Co.
Electric traveling crane.—Vaughan Crane Co., Ltd.
Diesel engine.—Ruston & Hornsby, Ltd.
Electric lamps.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Motor generator set, &c.—Brush Electrical Engineering Co., Ltd.
W/t apparatus.—H. W. Sullivan, Ltd.; Gambrell Bros., Ltd.; Radio Instruments, Ltd.; Dorman & Smith, Ltd.; Veritys, Ltd.
W/t fittings.—Player & Mitchell; Westminster Engineering Co., Ltd.; McGeoch & Co., Ltd.; Lawden & Poole; Veritys, Ltd.; J. Lavick, Ltd.
3,000 nightsight and telephone lamps.—General Electric Co., Ltd.

WAR OFFICE.
Aluminium.—British Aluminium Co., Ltd.
Inert electric cells.—Edison Swan Electric Co., Ltd.; Siemens Bros. and Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Electric furnaces.—Electric Furnace Co., Ltd.
Signalling torches.—C. A. Vandervell & Co., Ltd.
Electric lighting installation at Queen Mary's Buildings, Westminster.—G. W. Cross & Co.

AIR MINISTRY.
Storage battery (Felixstowe).—Tudor Accumulator Co., Ltd.
Delco ignition spares.—Delco Remy, Ltd.
Electrical measuring instruments.—E. Turner.
Generator.—W. Mackie & Co., Ltd.
Generator and spares.—Newton Bros. (Derby), Ltd.
Magneto spares.—North & Son, Ltd.
X-ray apparatus.—Watson & Sons, Ltd.

POST OFFICE.
Manufacturing, supply, drawing-in, and jointing cable.—Central-Clerkenwell; Sloane-Kensington; Kensington-Holborn; City-Bishopsgate; Gerrard-New Western; and Holburn-Gerrard: Western Electric Co., Ltd. Bath-Bathford; Uxbridge-Slough: Pirelli-General Cable Works, Ltd. Manchester-Gatley-Alderley; Ormskirk-Southport; Blackburn-Bolton; Preston-Ormskirk: British Insulated & Helsby Cables, Ltd. Guildford-Godalming; Birmingham-Coventry: W. T. Henley's Telegraph Works Co., Ltd. London (Trunk Telephone Exchange), Clapham Common: Siemens Bros. & Co., Ltd.
Electrical equipment.—Leeds H.P.O. sub-station: General Electric Co., Ltd.
Lift.—Cardiff H.P.O. local telephone exchange: W. Wadsworth & Sons, Ltd.
Telephone exchange equipment.—Leigh, Lancs.: Western Electric Co., Ltd. Sub-contractors for batteries: Hart Accumulator Co., Ltd.; for charging machines: Electric Construction Co., Ltd. London Toll; Birmingham Central: Western Electric Co., Ltd. Margate: General Electric Co., Ltd. East Ham: British L. M. Ericsson Mfg. Co., Ltd. Sub-contractors for batteries: Chloride Electrical Storage Co., Ltd.; for charging machines: Crompton & Co., Ltd.; Higgs & Hill. London, S.W.: J. Duckworth. Rochdale: Relay Automatic Telephone Co., Ltd. Hayling Island, Hants.: Automatic Telephone Mfg. Co., Ltd.
Experimental radio-telephone transmitting station, Rugby: Western Electric Co., Ltd.
Switchboards and cabling.—General Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—H. Tinsley & Co.
Battery boxes.—Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Porous Leclanché cells.—Edison Swan Electric Co., Ltd.; Fuller's United Electric Works, Ltd.; General Electric Co., Ltd.; Siemens Bros. and Co., Ltd.
Earth clips.—Farmer, Stedall & Co.
Loading coils.—Western Electric Co., Ltd.
Cords for telephones.—British Insulated & Helsby Cables, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; G. Jennings.
Indicator lamps.—General Electric Co., Ltd.
Water meters.—Electro Flow Meters Co., Ltd.
Charging panels.—Power Equipment Co., Ltd
Plugs for telephones.—E. Turner.
Battery-charging sets.—Stuart Turner, Ltd.
Lead sleeves.—Locke, Blackett & Co., Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss; Bullers, Ltd.
Insulating tape.—Ioco Rubber & Waterproofing Co., Ltd.
Telephones.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; International Telephone Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
G.I. wire.—Shropshire Iron Co., Ltd.; Whitecross Co., Ltd.

CROWN AGENTS FOR THE COLONIES.
Electric lighting plant.—Austin Motor Co., Ltd.
Generating plant.—Mirrlees, Bickerton & Day.
Telegraph instruments, &c.—Siemens Bros. & Co., Ltd.
Telephones, &c.—British L. M. Ericsson Mfg. Co., Ltd.
Train lighting spares.—Chloride Electrical Storage Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Radio Communication Co., Ltd.

East Grinstead.—Urban District Council.
1,250 yd. of cable (£675).—W. T. Henley's Telegraph Works Co., Ltd.

London.—London Electric Railway. Accepted:—
Cosmos gasfilled lamps.—Metro-Vick Supplies, Ltd.

Glasgow.—Tramways Committee. Accepted:—
Lead-covered cable.—Western Electric Co., Ltd.
Trolley cord.—Joseph Cookson, Ltd.; and Edinburgh Roperie and Sailcloths Co., Ltd.
Commutators.—P. R. Jackson & Co., Ltd.
Steel tubing.—Stewarts & Lloyds, Ltd.
Switchboard for subway.—Bertram Thomas.
Steel track shoes.—Acme Steel and Foundry Co., Ltd.
Carborundum blocks.—W. Gray & Co.; Wilson, Feather & Co., Ltd.; Mitchell's Emery Wheel Co., Ltd.; and Carborundum Co., Ltd.
.102 double cotton-covered wire.—Siemens Bros. & Co., Ltd.
Electric drilling machine.—Equipment and Engineering Co., Ltd.
Pumps for subway section.—Stothert & Pitt, Ltd.

Lynn.—Town Council. Accepted:—
Induced-draught plant (£395).—Davidson & Co.

Penmaenmawr.—Urban District Council. Accepted:—
Cables (£6,886).—British Insulated & Helsby Cables, Ltd.
Trenching (£2,621).—R. Rowlands.

Salford.—The note on page 260 of the issue of the ELEC. REV. of August 15th should have been under the heading "Manchester."

Southend-on-Sea.—Town Council. Accepted:—
Tramcar equipment.—English Electric Co., Ltd., six bogies (£2,208); Brush Electrical Engineering Co., Ltd., 10 trucks (£2,500).

Slaithwaite.—Urban District Council. Accepted:—
Supplies of switchgear equipment for Manchester Road sub-station and the Town Hall distributing station (£944).—Metropolitan-Vickers Electrical Co., Ltd.
Supply of meters.—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

Iron and Steel Institute.—AUTUMN MEETING.—Wednesday, September 3rd. At Prince's Galleries, Piccadilly, London. At 9 p.m. Reception by the president.
Thursday and Friday, September 4th and 5th. At the Conference Hall, British Empire Exhibition, Wembley. At 10.30 each day. General meeting.
Machine Tool and Engineering Exhibition.—September 5th-27th. At Olympia, London.

Notes.

The Severn Barrage Scheme.—In accordance with recent statements in Parliament, the Government has decided to proceed at once with certain preliminary investigations in order to ascertain the feasibility of the scheme for using the tidal power of the River Severn for the production of electrical energy by the erection of a barrage across the river. The work has been entrusted to the Department of Scientific and Industrial Research, and the Lord President has appointed a Committee, constituted as follows, to control the operations:—Mr. G. S. Albright, C.B.E., J.P. (Chairman); Professor A. H. Gibson, M.Inst.C.E., M.I.Mech.E.; Mr. G. W. Lamplugh, F.R.S.; Mr. Maurice Wilson, A.M.Inst.C.E.; and Dr. J. S. Flett, O.B.E., LL.D., F.R.S., Director, Geological Survey and Museum.

The feasibility of the Severn scheme depends upon the possibility of finding satisfactory foundations for a barrage. Accordingly the first stage of the investigation will involve:—

(*a*) The study by the Geological Survey of the stratigraphical formations in the neighbourhood of the sites suggested for the erection of the barrage;

(*b*) Preliminary soundings with a view to determining the contour of the river bed at the sites; and

(*c*) Preliminary measurements of the flow of water at different states of the tide.

The cost of the investigations is estimated at £95,000. Sir Maurice Fitzmaurice, C.M.G., F.R.S., and Sir John Purser Griffith, M.A.I., M.Inst.C.E., have been invited to submit a joint report before the end of this year as to the possibility of constructing a barrage on one or more of the sites suggested on the assumption that safe foundations exist. The data which will be provided as a result of the geological and hydrographical investigations will be placed at their disposal. The staff of the Geological Survey has already begun the inquiry, and its report will probably be ready for submission to the Committee before the end of September.

Particulars of the scheme outlined by the Ministry of Transport in 1920 were published in our pages at the time; it was proposed to construct a dam across the Severn, which would carry a road and railway, greatly facilitating transport between South Wales and the west of England, and would provide a large lake for shipping; generating plant of 500,000 h.p. was to be installed, together with pumping plant to raise water to a high-level reservoir, which would supply power during periods when the main plant was idle.

Inquest.—An inquiry took place recently at Falkirk into the death of a retired moulder whose body was discovered after a severe thunderstorm on the bank of the River Carron. He had evidently taken shelter from the storm under a hedge, through which there ran a stay-wire belonging to a pole in a line of six 6,000-V power cables. A flash of lightning struck the pole, and one of the wires fell upon the wooden cross-arm to which the stay-wire was attached. The man's right hand was marked, though not burned, and this suggested that his hand had been resting on the stay-wire. Two people who discovered deceased's body were unable to approach it because of the electricity in the surrounding damp ground. The Electric Power Company whose line was affected switched off the current and it was then found possible to reach the body; artificial respiration was tried without avail. The ground was quite warm and steam was rising, while under the hedge decayed foliage and brushwood were smouldering. The jury found that the man died as the result of an electric shock, sustained either from the power wire or the lightning stroke during the thunderstorm.

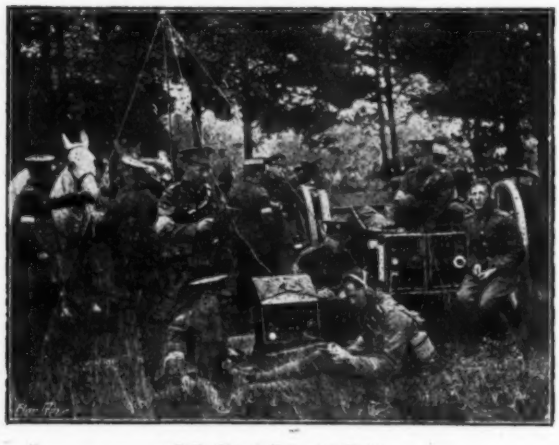
Fatality.—Thomas Smith, electrician at the Hydropathic power house, near Crieff, Perthshire, while attending the dynamo, had his arms caught by the driving chain and was badly injured. He was removed to Perth Royal Infirmary, and subsequently died.

The Australasian Association.—The Adelaide correspondent of *The Times* reports that the congress of the Australasian Association for the Advancement of Science opened on August 25th. Large Australian and New Zealand delegations are present, and an important *agenda* will occupy the week. Lieutenant-General Sir John Monash, who succeeded Sir George Knibbs, the Director of the Institute of Science and Industry, delivered the presidential address on "power development." He said that Australian investment in electrical transmission had been relatively negligible, and that much research should be done before committing themselves deeply to a more extensive use of present methods.

Speaking at the mayor's reception, Sir George Knibbs said that it was well that Australia's spirit of appreciation for science had grown so rapidly, as it was essential to acquire sufficient wealth and population to meet all contingencies. Sir John Monash pleaded for a greater recognition of science by public men, and for larger State grants to scientific institutions. Australia could not afford to blunder through, he said, but must progress only along scientific lines.

Appointments Vacant.—Junior Testing Assistant, for the Salford Corporation electricity department. Plumber-Jointers for the Salford Corporation electricity department. Distribution Engineer for the Workington Corporation Distribution Scheme. (See our advertisement pages to-day.)

Army Signals.—One of the most interesting and important functions of the Royal Engineers is to maintain communication between the various sections of the Army, for which purpose the resources of science are utilised to the full. During the past fortnight the First Division has been undergoing



"R.E. Signals" in the Fie'd.

its annual signals test, in accordance with a very strenuous programme, and the accompanying illustration shows a detachment of the Royal Engineers at work with portable wireless equipment near Aldershot.

Aldershot Command Searchlight Tattoo.—The results of the Tattoo (in aid of military charities) this year have been very satisfactory, the gross receipts being £10,310, as compared with £5,117 last year, and the total attendance 81,941 as compared with 41,516. On the best night (June 21st) the gross receipts were £3,775, as against £1,746, and the attendance 34,774, as against 15,762.

Educational.—Northampton Polytechnic Institute, E.C.1.—The prospectus for the Session 1924-25 has come to hand. This contains exhaustive details of the curricula in civil, electrical, and mechanical engineering and allied sciences, particulars of the teaching staff, and information as to the social side of the Institute.

The Polytechnic, Regent Street, W.1.—Electrical Engineering Department, Session 1924-25. Day courses in Electrical Engineering commence on September 16th. Evening classes commence on September 29th. Early application for admission to the day course is advised. Enrolment for evening courses commences September 17th. Full particulars free on application to the Director of Education, The Polytechnic, 309, Regent Street, W.

University College.—The Faculty of Engineering of the College has issued its programme of arrangements for the session 1924-25. This contains detailed information as to entry, examinations, degree courses, scholarships, tutorial staff, and many other matters.

Social Event.—The "Elliott" Social Association (Messrs. Elliott Bros. (London), Ltd.), held its annual garden fête and sports meeting at Colfe's Grammar School Sports Ground, Eltham Road, on August 16th. About 600 of the firm's employés attended; Mr. W. O. Smith (chairman) and Mr. A. W. Atkyns (director) were present. A long programme of athletic events was arranged, and during the afternoon music was provided by the G.P.O. military band.

Fires in London.—Dr. Waldo, in his annual report for 1923, says it is his duty under the local City of London Fire Inquests Act of 1888, which is unique in its scope in Great Britain, to conduct judicial inquiry into the causes and all the circumstances (including building construction and means of escape from fire), of non-fatal as well as fatal fires. Also he has power to send persons direct for trial for arson or incendiarism without such persons going before the magistrates.

As the result of 23 years' experience gained by Dr. Waldo in this way, he has drawn up a series of suggestions in the form of fire cards to be distributed among offices, workshops, and other buildings throughout the City. Larger poster notices are to be exhibited in schools and public buildings. Dr. Waldo says that the public generally are intensely ignorant about all matters connected with fires, and that the education of the rising generation, and of parents through school children, is the best and cheapest insurance against unnecessary loss of property and life by fire.

He points out the vital need of citizens all acquainting themselves with the means of escape from fire before a fire actually occurs, since "it is too late to begin making inquiries when the building is in flames." He says he finds that on an average in every third fire investigated by him the means of escape are inadequate and fall short of the provisions made by the London Building Acts (Amending Act) of 1905—the direct outcome of the fatal electro-celluloid fire in Queen Victoria Street, City, which killed nine girls and a youth in 1902. The inquest on this fire—held before Dr. Waldo—lasted 12 days, and, *inter alia*, led to the introduction of the pompier or hook ladder suggested by him, which has since led to the saving of numerous lives.

He has investigated, with the assistance of the City Electrical Engineer, 16 fires in the city which were due to electrical defects.

The directions include instructions as to what to do in the event of fire, and useful hints for the prevention of fire, all of which are very practical and worthy of careful attention. They should be posted up, and studied.

Illumination of Lifeboats.—New rules relating to the life-saving appliances to be carried on board ship have been made by the Board of Trade and laid before Parliament. They are to come into force on July 1st, 1925. The carriage of a motor-boat or boats is made compulsory on vessels carrying more than 15 lifeboats, and these motor-boats must be fitted with searchlights. On all foreign-going passenger steamships in which the boat deck is more than 30 ft. above the water, provision is required for the illumination from the ship of the lifeboats when alongside or in process of being launched.

A Large Turbine.—Sixty railway wagons were used last week to transport the parts of a 1,000-ton steam turbine that has been built in this country from Newcastle-upon-Tyne to Wallsend, for shipment to Chicago.

The Franklin Institute Centenary.—On September 17th-19th the centenary of the founding of the Franklin Institute will be celebrated at Philadelphia. The Act incorporating the Institute was signed on March 30th, 1824, by the Governor of Pennsylvania, and during the past hundred years the Institute has accomplished an immense amount of scientific work and acquired a world-wide reputation. In addition to the commemorative exercises, which will include addresses by Prof. Elihu Thomson (Hon. Secretary of the Centenary Celebration Committee), and Prof. Sir Ernest Rutherford, a large number of papers will be read before sectional meetings by leaders in science and industry. The authors include Sir W. H. Bragg, Prof. E. G. Coker, Prof. F. G. Donnan, and Sir Charles A. Parsons, as well as many noted American professors and engineers.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Mr. R. W. DALTON, recently appointed Senior British Trade Commissioner in Australia, on arrival at Melbourne was welcomed by members of the Australian Association of British Manufacturers; according to the *Industrial Australian and Mining Standard*, the president, Mr. J. A. Daniel, said Mr. Dalton had achieved great success in New Zealand, and had rendered very valuable service to British manufacturers without coming into conflict with New Zealand interests. In reply, Mr. Dalton said he was a firm believer in the development of the Imperial relationship; this could be best fostered by the development of Imperial trade. He was not there to get whatever he could for Britain, but to endeavour to foster mutual trade between the two countries.

Mr. W. G. MESSER, A.M.I.E.E., has recently arrived in Sydney, N.S.W., from England to join the staff of Armstrong-Whitworth Proprietory, Ltd., in connection with hydro-electric installation work.

We have received a copy of *Westinghouse International*, of which the special feature is a portrait of Mr. B. G. LAMME, who died on July 8th, and a biographical notice of his career.

Mr. VINCENT Z. DE FERRANTI was due home on August 22nd after an Empire tour, including Canada, New Zealand, Australia, and South Africa.

Obituary.—The death is reported from Toulouse of M. GABRIEL BUTTICAZ, who has been associated with the establishment of hydro-electric stations in Eastern France.

MR. A. J. BARNES.—The death occurred at Edgbaston, Birmingham, on Friday last, of Mr. Alfred J. Barnes, of the Western Electric Co., Ltd.

Will.—MR. J. P. ACHURCH.—The late Mr. John Philip Achurch, Edgbaston, Birmingham, formerly managing director of Messrs. Parker, Winder & Achurch, electrical supplies dealers, &c., left estate valued at £10,351 gross (£2,851 net personalty).

New Company Registered.

Ingersoll Wireless Co., Ltd. (200,000).—Private company. Registered August 22nd. Capital, £3,000 in £1 shares. To carry on the business of engineers, advisers, experts, consultants, contractors, and the like in connection with wireless telephony and telegraphy, &c. The first directors are:—J. H. Freeborough, 61, Montgomery Terrace Road, Sheffield, incorporated accountant; W. F. Gracie, Broom Road, Rotherham, manager. Qualification, £100. Remuneration as fixed by the company. Secretary: H. H. Whittles, 185, Machon Bank Road, Sheffield. Registered office: 4, Swinegate, Leeds.

Official Returns of Electrical Companies.

British Insulated and Helsby Cables, Ltd.—Particulars filed of £1,000,000 mortgage debenture, redeemable with a premium of 3 per cent. authorised June 19th, and covered by trust deed dated July 15th, 1924, constituting a specific charge on various freehold and leasehold properties and a floating charge on the undertaking and other assets of the company (subject to £85,130 4½ per cent. first mortgage debenture stock and £27,930 5 per cent. mortgage debenture stock, being amounts outstanding of certain issues of stock secured (*a*) by trust deed dated July 22nd, 1901, and certain supplemental deeds; and (*b*) trust deed dated November 29th, 1910), the amount of the present issue being £700,000, carrying interest at 5 per cent. Trustees: Hon. Sir Arthur Stanley, G.B.E., C.B., M.V.O., Treasurer's House, St. Thomas's Hospital, S.E.1; and Sir John S. Harmood Banner, Bt., M.P., 24, North John Street, Liverpool. (The last £250,000 of the stock now issued was underwritten at an underwriting commission of 1½ per cent. on the nominal value of the stock, plus an overriding commission of ½ per cent. The stock was issued at £98 per £100.)

Upton & Garrett, Ltd.—Sir Harold J. de Courcy Moore, of 2, Gresham Buildings, Basinghall Street, E.C., was appointed receiver on August 6th, 1924, under powers contained in debentures dated November 8th, 1923, and May 29th, 1924.

Auto-Welding and Engineering Co., Ltd.—A. H. P. Howard, of 46a, Pear Tree Street, Finsbury, E.C., was appointed receiver and manager on August 11th, 1924, under powers contained in debentures dated April 25th, 1923.

Electrical Contracts and Maintenance Co., Ltd.—C. H. Barham, of College Hill Chambers, E.C., was appointed receiver and manager on August 13th under powers contained in debenture dated May 30th, 1924.

Pickvance, Ltd.—Issue on August 11th, 1924, of £150 debentures, part of a series already registered.

Petersfield Electric Light and Power Co., Ltd.—Debenture charged on the company's undertaking and property, including uncalled capital, dated August 5th, 1924, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd., not exceeding £5,000.

Ford Electrical Co., Ltd.—Particulars filed of £1,000 debentures authorised July 11th, 1924, constituting a floating charge on all the company's property, present and future, including uncalled capital, the whole amount being now issued.

Hindhead and District Electric Light Co., Ltd. (75,361).—Return dated July 24th, 1924. Capital, £30,000 in £1 shares. 25,000 shares taken up. £14,500 paid. £10,500 considered as paid. Mortgages and charges, £6,100.

City Notes.

Spanish Company.—At the extraordinary meeting of the *Société Internationale d'Energie Hydro-Électrique* (*Sidro*), held in June, it was decided to increase the company's capital from 125,000,000 to 162,500,000 pesetas, by the creation of 125,000 250-fr. preference shares and 25,000 250 fr. ordinary shares. These funds, the report stated, were destined to increase the company's share in the Barcelona Traction, Light and Power Co., Ltd., with a view to its financial reorganisation, reducing its fixed charges and converting them, as far as possible, into pesetas, in which coin its receipts are made. In these negotiations the big concerns, the Compañia Hispano-Americana de Electricidad and the Crédit Suisse, had intervened to the general advantage. The shares taken in the new issue by the several companies mentioned were as follows:—Société Financière de Transports, 12,500 preference shares and 2,500 ordinary shares at par; Compañia Hispano-Americana de Electricidad, 55,000 preference shares and 11,000 ordinary shares at 450 fr.; Crédit Suisse, 57,500 preference shares and 11,500 ordinary shares at 450 fr.

Austrian Company.—The report for 1923 of the Austrian Siemens-Schuckert Works Co. states that the short-time working with which the year started was gradually overcome, and at the end of the year a weekly shift of 48 hours was being worked. In the present year, however, the difficulties of effecting sales on account of competition are said to have become accentuated; the number of workmen employed at the end of May, 1924, was 6,787. The accounts for 1923 closed with net profits in paper crowns.

Aberdeen Suburban Tramways Co.—The profit for the half-year ended July 31st was £1,858, and to this is added £5,246 brought forward, making £7,104. It is proposed to pay a dividend of 7 per cent. for the past year, to transfer £1,800 to the renewal and depreciation account, and to carry forward a balance of £3,018. The meeting is being held to-day (Friday).

Stewarts & Lloyds, Ltd.—In consequence of the extension of the company's interests, embracing the acquisition of coal and iron fields, a resolution to increase the capital was placed before, and approved by, an extraordinary general meeting of shareholders on August 19th. It is proposed to issue 2,700,000 additional deferred shares of £1 each, raising the capital to £6,800,000.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

County of London Electric Supply Co.—£1,500,000 5½ per cent. one-year notes, issued at 99¼ per cent., partly paid and fully paid.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—An interim dividend of 2½ per cent., less tax, has been declared upon the ordinary shares. No interim dividend was paid last year, but 6 per cent. was paid at the end of the year.

Chadburn's (Ship) Telegraph Co., Ltd.—The directors announce a dividend of 3 per cent., less tax, on the ordinary shares for the year.

Bolckow, Vaughan & Co., Ltd.—The directors have decided not to pay the half-yearly dividend on the preference shares.

Stocks and Shares.

MONDAY EVENING.

STOCK EXCHANGE markets continue to reflect the favourable effects of the confidence aroused by the signing of the London Agreement. While everyone recognises that this agreement is but a first step towards permanent peace, the mere fact of its having met with international respect encourages the impression that it will form the basis of a businesslike solution of many world difficulties that have prevailed since the war. Taken in conjunction with the mild optimisms uttered during the past few days by responsible people in regard to the better outlook for trade, the Pact is deemed sufficiently firm ground upon which to base a genuine hope of better things in the near future.

That money keeps so easy at the very time when a rise in the Bank Rate had been generally expected is a bull point for gilt-edged and other investment stocks. Industrials also are in better fettle, and, in spite of the holiday influences, there is a fair amount of business going on in many of the Stock Exchange markets. Therefore, attention has again been directed to some of the Underground Railway stocks. Districts are being bought on the idea that the Exhibition traffics

will lead to the payment of an increased dividend at the end of this year. The price is 30s. better at 52. Metropolitans could not hold their rise, and the stocks have given way to 79. The Underground Electric Railways group is steady, the £10 shares maintaining most of their recent improvement.

Tramway and transport stocks, however, languish in the doldrums. British Electric Traction preference shed a point. Such stocks as the London United Tramway debenture and the London & Suburban Traction shares show a tendency to dwindle in price. Metropolitan Electric Tramways 4½ per cent. debenture stock changed hands a few days ago at 77½ and 78, but the 5 per cent. debenture stock has not been dealt in since August 7th, when stock was sold at 77½. London United Tramways 5 per cent. preference shares, nominally quoted at 3s.-4s., were done last Friday at 3s. 6d., and, on the same day, the 4 per cent. debenture stock came to market at 45. A bargain was marked recently in Provincial Tramways ordinary at 2s.; the company's £10 6 per cent. preference, upon which no dividend has been paid since January, 1923, stand at the nominal price of 30s. South Metropolitan Electric Trams 4 per cent. debenture stock 1940 is quoted at 72 middle. There is a fair amount of business passing in Isle of Thanet Electric Tramways 4 per cent. debenture stock, on the basis of 70½. The £5 preference shares command the high price of 6¼.

Whitehall Electric debentures are better in both cases, old and new alike. The old has risen to 97, and the new, which came out at 94, now stands at 1 premium. The preference shares, however, remain on the dull side, with the old at 19s. 6d. and the new at 19s. The difference between the two classes of preferences is that the new shares carry only three months' dividend, due in October, against the old share's dividend of six months, which will become payable then. Tokio Electric bonds gave way a trifle, upon the rumours of further severe earthquake shocks in Japan, but the price quickly rallied to its previous level of 90, at which it now remains.

The new 5½ per cent. notes issued by the County of London Co. at 99½ are 10s. premium. The price has been up to nearly 15s. premium, which, however, looked too high, in view of the short-dated character of the notes. The company's shares are unchanged at 47s. 6d., but City Lights rose 9d. to 47s., this being practically the only change throughout the London list. Quotation of the various ordinary shares ex the interim dividends has had no effect upon values, but the dealers in the market report that they are doing a reasonable amount of trade, and that they could do more if they had a larger number of shares available for dealing in. Folkestone Electric new ordinary are changing hands freely on the basis of 6s. premium. The old stand at 30s. in their £1 form.

General Electrics hold their little improvement at 18s., and other electrical manufacturing shares are steady. Edisons are a shade easier at 4s. 9d. There has been a sharp setback in Henleys, Callenders, and British Insulated, the falls being about 1s. 9d. to 2s. in each case. The rise had been too rapid to last, and for the prices to have approached £3 per share was premature, in the light of the present paid dividends. India Rubber shares have come in for a little attention, and the price has hardened to 14s. 3d. No interim dividend was paid in June, it may be recalled, but with telegraph manufacturing companies doing well, speculation toys with the idea that the India Rubber company—Silvers, as its shares are still called in the Stock Exchange—will have its turn before long. Enfield Cable ordinary are better at 44s. xd. The company's 7½ per cent. preference can be bought at 24s. 3d., to yield 6¼ per cent. on the money. They make a sound investment.

Anglo-Argentine Tramways shares are better again, although nothing definite seems to be known in regard to the negotiations rumoured last week to be on foot between the company and the Buenos Ayres municipality for permission to be given to the former to raise its rates. These negotiations have been going on for some time past, and the recent rise of 7s. 6d. in Anglo-Argentine Tramways first preferences suggests that there may be something moving in this direction before long. Brazilian Tractions are steady and unchanged at 52. Mexico Trams are dullish, and, in Mexican Light & Power, the preferred shares are 2 points lower.

Marconis continue to attract a fair amount of speculative attention, and the price shows a further rise to 35s., having been 36s. 3d. Canadians are a little lower at 6s. 9d. The cable group is distinguished only by its placidity. There is not a change in the Eastern group. United River Plate Telephones are 1/16 down, and other such shares keep their previous prices.

Babcock & Wilcox have gone back to 48s., losing the ninepence which they gained a week ago. The market for iron, steel and allied shares leans rather to the dull side, notwithstanding the cheerfulness which prevails in some of the trade circles. The rubber market is exceedingly quiet, there being next to nothing going on. The prospect of a permanent peace flatters the hope that there may be a further correction of the New York exchange in relation to the pound sterling, and, for this reason, some of the dollar stocks are beginning to ease off in their prices. On the other hand, improvements have occurred in Rio Tramway firsts at 94½ and San Paulo firsts at 96, in consequence of the more settled conditions which evidently prevail in Brazil. General Electric of New York 5 per cent. bonds have risen to 120, though some of the other American industrials quoted in dollars are somewhat reactionary.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1922.	Dividend. 1923.	Price Aug. 25, 1924.	Rise or fall.	Yield, p.c.
Brompton Ordinary	1	12	10	27/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	2	—	7 5 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	47/-	+9d.	6 7 10
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	2⅜	—	6 6 4
do. do. 6 % Pref. ...	1	6	6	23/6	+1/-	5 6 8
Edmundson's Ordinary	5	7	7	5	—	4 5 4
do. 6 % Pref.	5	6	6	6⅜	—	5 11 7
Kensington Ordinary	5	13	14	9⅜	—	7 9 4
London Electric	1	10	10	31/-	—	6 9 0
do. do. 6 % Pref. ...	5	6	6	6⅜	—	5 11 7
Metropolitan	1	9½	10	1⅜	—	6 1 8
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	18/3	—	4 7 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	12⅝	—	6 16 0
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1⅛	—	5 12 0
Westminster Ordinary	5	13	15	10xd	—	7 10 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/6	—	7 13 10

Home Rails.

Central London Ord. Assented Stock	4	4	70½	—	5 13 6
Metropolitan ... ... ,,	3½	4	70¼xd	−1	5 1 3
do. District ... ... ,,	3	3½	52	+ 1½	6 14 7
Underground Electric Ordinary	10	Nil	Nil	2⅜	—	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—	Nil
do. do. Income Bonds	5	6	99	—	*6 1 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref. ... ... Stock	6	6	109½	—	5 16 0
do. Def. ... ... ,,	1½	1½	23⅜	—	6 6 4
Chile Telephone	5	6	6	5⅞	—	5 8 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	16⅛	—	6 3 0
Eastern Tel. Ord.	Stock	10	10	164½	—	6 1 7
Globe Tel. and T. Ord.	10	10	10	17⅜	—	5 15 3
do. do. Pref.	10	6	6	11½	—	5 6 10
Great Northern Tel.	10	24	22	27½	—	7 18 6
Indo-European	25	7	7	29½	—	*5 6 1
Marconi	1	15	10	1⅝	+ ⅛	5 14 3
Oriental Telephone Ord.... ...	1	12	12	1⅞	—	*6 3 0
United R. Plate Tel.	5	8	8	6⅝	— ⅛	*5 16 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	—	6 4 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	8⅞	+ ⅛	8 0 0
do. do. 2nd Pref. ...	5	5½	6	3	— ⅛	10 0 0
do. do. 5% Deb. ... Stock	5	5	79½	—	6 16 0
British Electric Traction Ord. ... ,,	6	6	91½	—	6 11 2
do. do. 6% Pref. ... ,,	6	6	100½	−1	5 19 3
Brazil Traction 100	4	4	52	—	7 13 0
Brit. Columbia Elec. Rly. Pce. Stock	5	5	87½	—	5 14 3
do. do. Preferred ,,	5	90/-	62½	—	*5 5 8
do. do. Deferred ,,	8	127/-	103½	—	*6 5 0
do. do. Deb. ,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ... 1	5	2½	5/6	—	9 1 10
London United Tram. Deb. ... Stock	4	4	45½	—	8 15 10
Mexico Trams. 5% Bonds ... —	Nil	5	66	—	7 11 6
do 6% Bonds ... —	Nil	Nil	44½	−1	Nil
Mexican Light Common ... 100	Nil	Nil	16	—	Nil
do. Pref. 100	Nil	Nil	39	−2	Nil
do. 1st Bonds ... —	5	5	59½	−1	8 8 0

Manufacturing Companies.

Babcock & Wilcox... 1	90	13	48/-	−9d.	*5 0 0
British Aluminium Ord.... ... 1	5	5	28/9	—	3 15 3
British Insulated Ord. 1	15	15	56/3	−1/9	5 6 9
Callenders 1	15	15	55/-	−2/-	5 9 1
do. 6½ Pref.... 1	6½	6½	23/3	—	5 11 10
Crompton Ord. 1	5	Nil	⅛	—	8 17 10
Edison-Swan 4/-	7½	—	4/9	−3d.	6 0 0
do. ,, 5% Deb. ... ... Stock	5	5	79½	—	6 15 6
Electric Construction 1	10	10	1⅞	—	6 19 0
English Electric 1	8	5	15/3	—	6 1 9
do. do. Pref. 1	6	6	19/6	—	6 3 1
Gen. Elec. Pref. 1	6½	6½	23/-	—	5 13 1
do. Ord. 1	5	5	18/-	—	5 12 0
Henley 1	15	15	56/3	−1/9	5 6 9
do. 4½ Pref. 5	4½	4½	4⅛	—	5 6 0
India-Rubber 1	10	5	14/3	+6d.	*7 0 6
Met.-Vickers Pref.... 3	8	8	2⅜	—	6 14 9
Siemens Ord. 1	5	—	1	—	5 0 0
Telegraph Con. 12	20	20	24½	—	*4 17 7

* Dividends paid free of Income Tax.

The World Power Conference at the British Empire Exhibition.

(*Concluded from page* 301.)

Standardisation.

On July 10th, in Hall I, the subject of standardisation was to have been discussed during the afternoon session, under the chairmanship of Sir Archibald Denny (Great Britain), chairman of the British Engineering Standards Association, the oldest organisation of its kind in the world. The ten papers were taken as read, the chairman describing those from Austria, Germany, and Sweden as dealing with the national organisation; those from Holland with subjects of scientific interest, and with the special case of the Dutch East Indies, where the distance from home made electrical standardisation essential; and those from Norway and the U.S.A. with definite new proposals; while Mr. C. Le Maistre pleaded for co-operation and the unifying of the needs of industry for the sake of economy and to prevent the overlapping of effort.

Mr. A. E. Kennelly (U.S.A.), then put a resolution to the meeting recommending that the World Power Conference should not engage directly in standardisation, but that it would be preferable to refer such matters to the existing appropriate organisations. The motion was supported by the chairman, Baurat Dr. Ing. F. Neuhaus (Germany), Dr. G. Semenza (Italy), and Mr. R. Kapp (England), but Mr. Morton said that the International Electrotechnical Commission was essentially electrical and, so far as he knew, there was no organisation for dealing with mechanical standardisation internationally. After some discussion as to how the I.C.E. could undertake such work and some explanation by the chairman, the resolution was passed by the meeting, which was then terminated.

Review of the Sessional Activities.

On Friday, July 11th, the concluding meetings of the Conference were held, there being sessions in the morning and afternoon in the large hall.

At the morning meeting, Mr. O. C. Merrill (U.S.A.) presided, and in opening the meeting said the endeavour would be made to express in the form of resolutions the decisions arrived at by the International Executive Committee, although what had actually been accomplished during the various sectional proceedings was far too great to be expressed definitely in the form of resolutions. Not only had the Conference brought together the leading technical men of the world, but the papers presented to the Conference constituted the greatest contribution, in his judgment, on the subject of power that had ever before been brought together—a series of contributions which would serve as text-books for engineers for many years to come. It had been recognised that scientific information was common property, and that had been the underlying idea all through the Conference. The financial side of power production and development had also been discussed, and it had been learned that there were two methods of dealing with this aspect of the matter. It could be considered as a speculation or an investment. Capital was more fluid and more subject to economic, political, and social changes than any other commodity. It had been realised, therefore, that if they built ahead of the market and if projects were surrounded by uncertainties, economic, political, or otherwise, and if power development were left on a speculative basis, the price would have to be paid in the rates charged for power. If, on the other hand, they could surround power development with a reasonable certainty, if the man who put his money into it knew under what conditions it was going to be used, and knew that it was protected, then power development was being dealt with from the standpoint of an investment. In that case, the cost of money would be reduced and, consequently, the rates charged to the users of power would be correspondingly lower. That was the fundamental and underlying principle of the whole subject, *viz.*, to secure the best service at the lowest cost to the consumer, remembering that, above all, in the ability to allow personal initiative to take its course lay the best opportunity for development. The Conference had also dealt with the social relations of power development, and they had learned, if they did not know it before, that in electrical energy they had one of the most important factors in modern life for ameliorating unsatisfactory social conditions and raising the status of the man who worked with his hands. By doing this, they had the opportunity of decentralising their industries and carrying them far away from congested areas and great cities, and thus bringing better conditions into the lives of the working people. It could not fail to be of the greatest possible value that so many individuals from so many nations had met together, irrespective of the position that might have been taken up by any group in the years just past, and they had been able to meet round a common council table in friendly co-operation. The more they were able to do that in the future the more would they learn, as they had learned at the Conference, the views and purposes of other people, and the more they created these personal relationships and acquaintanceships the less would it be possible for any other considerations to disturb the peace between them in the future. It was this fact which he counted as the outstanding feature of the Conference.

The meeting had before it the Memorandum and Recommendations approved by the International Executive Committee, and the chairman read the Memorandum as follows:—

Memorandum.

Actuated by a common desire for the conservation and development of power resources throughout the world, the study of power problems, and generally for the carrying on of the work begun at the first World Power Conference, London, 1924, the foregoing (representatives of the various countries) have, for themselves and the respective national committees in the various countries, signed their names hereto.

1. It is desirable that the work of the first World Power Conference shall be continued, and that consideration shall be given to the advisability of forming a permanent Institution at a later stage under such title as may be found best to fit its activities, and to that end—

2. Each country participating in the first World Power Conference is invited to create and/or maintain a permanent National Committee, as far as possible representative of its interests in all aspects of power.

3. The existing representatives of the International Executive Committee of the first World Power Conference shall continue for the time being to carry out the necessary work arising out of the Conference as set forth in this Memorandum.

4. Each National Committee shall be entitled to appoint one delegate to represent it on the International Committee, and such appointments shall be made within six months from the date of this Memorandum.

5. In countries where it is not immediately convenient to appoint National Committees a correspondent may be appointed to keep in touch with the International Committee until such time as a National Committee can be appointed.

6. A meeting of the International Committee shall be convened within a reasonable time to decide upon the lines on which it would seem advisable to them (after conferring with their National Committees) to further the objects of the First World Power Conference, and in considering their scheme to arrange that there be no interference or overlapping with the functions of any existing international organisation.

7. The present Organising Director and his staff shall, for the time being, be the medium of communication between the countries represented on the International Committee of the World Power Conference for all purposes of the Conference.

8. The next meeting of the World Power Conference shall be held at a time and place to be determined by the International Committee, subject to the approval of the respective National Committees. So far as practicable, future Conferences should be held in different countries.

Dr. G. Semenza (Italy), in proposing the adoption of the above, said it was a wise course to move slowly, as was indicated in the Memorandum, as hasty action might very well lead to useless results. It was too soon to attempt to lay down a definite line of action, and the proposals had purposely been framed in as wide a manner as possible.

M. Genissien (France) seconded, and the motion was carried unanimously.

Sir Archibald Denny said that the section of the Conference dealing with standardisation had passed a resolution expressing the hope that the various matters would be dealt with by the appropriate national or international organisations. The Memorandum which had been passed practically gave effect to that, and therefore he would merely ask the International Committee to add to No. 6 of the Memorandum the words, "national or" in front of the words, "international organisation." There was only one regularly-organised international body, *viz.*, the International Electrotechnical Commission, but there were 18 national standardisation committees which were held together, more or less loosely at the moment, by meetings from time to time of the secretaries.

Mr. Ll. B. Atkinson (Great Britain) then moved the following resolution:—

Resolved: (1) That this Conference is of the opinion that the world's most crying need to-day is greater production and manufacturing activity among its peoples under conditions which will promote individual prosperity and happiness, and that this can be largely achieved by the fuller development of national power resources and by the establishment of the most economical means for the general distribution and utilisation of energy.

(2) The International Executive Committee of the First World Power Conference desires to place on record its thanks to authors of all countries who contributed papers to the Conference.

Mr. H. J. Pierce (U.S.A.) seconded, and the resolution was carried.

The chairman then moved:—

"The International Executive Committee of the First World Power Conference desires to express its thanks to the chairmen who presided at the various sessions of the Conference."

Mr. D. N. Dunlop seconded, and the resolution was carried.

The chairman moved:—

"That the visiting delegates to the first World Power Conference express their deep appreciation of the efficient manner in which the Conference has been organised and conducted by Mr. D. N. Dunlop and his associates, and their further appreciation of the gracious courtesies and generous hospitality so abundantly extended to them by their British associates."

Mr. D. Rushmore (U.S.A.) seconded and, in the words of the chairman, the resolution was overwhelmingly and unanimously carried.

Mr. D. N. Dunlop then moved:—

"The British Executive Committee desires to tender its sincere thanks to the officials and secretaries of the National Committees and to representatives of all ccuntries participating in the first World Power Conference whose effective co-operation contributed so greatly to its ultimate success."

In doing so, Mr. Dunlop referred to the splendid spirit of co-operation shown all round. He added that there was some opposition at first, because it was thought that the World Power Conference might overlap or interfere with the work of other organisations. That was a perfectly natural fear, but it was not the intention on the part of anyone connected with the World Power Conference to set up an organisation which would conflict with those already established. The learned institutions also looked a little askance at the scheme, because they thought that as the idea had issued forth from a body of manufacturers, it might not be conducted with that dignity that should surely belong to such a great undertaking. He hoped that one of the results of the Conference had been that this curious conception of the learned institutions about manufacturers had disappeared, and that there would be greater co-operation between these institutions of culture and learning and those who had to guarantee their work to the public. The doctor could not guarantee a cure, and the pastor could not give a guarantee of eternal life hereafter, but the engineer had to guarantee his work, and for that reason must be regarded as one of the greatest factors in the world's progress. Walt Whitman had said that the invincible State was the State of friends; that the invincible nation was the nation of friends, and it might be added that the invincible world was the world of friends. All those who had taken part in the Conference had done so in this spirit of friendship, and the endeavour had been to exclude no country from the Conference which had in some way contributed to this work in past centuries and would contribute to it in the centuries to come.

Mr. B. Longbottom (Great Britain) seconded the resolution, which was carried with acclamation.

Mr. Low (U.S.A.) then presented the following resolution:—

"Whereas it appears that Heathfield Hall, near Birmingham, built and occupied by James Watt, the scene of his last labours still containing its garret workshop, the tools and implements and personal belongings of the great master just as he had left them, is to be offered at public sale,

"And whereas the inaugurator of this age of power is a character of such world-wide interest and importance that it would be an appropriate and memorable act for this first World Power Conference to ensure the continuous existence in their present condition of these surroundings of his labour and of his death.

"Be it hereby resolved that the International Executive Committee of this Conference be requested to ascertain the conditions surrounding the property, the terms upon which it may be acquired, the willingness of the constituent bodies of the Conference to contribute the required sum, the conditions with regard to its acceptance and maintenance by some appropriate local or national body or authority, and to effectuate, if possible, the acquisition and such disposition of the property as will ensure its preservation and accessibility to the public."

Mr. Low said that Watt was a world character, and Great Britain must share him with the rest of the world, and it had therefore occurred to some of them to bring forward this resolution in the hope that it might defer the contemplated breaking-up of the property. The property was to be offered on the following Saturday for sale, and it would be a graceful and appropriate act for this First World Power Conference to set in motion machinery which might preserve it as a monument for coming generations.

Dr. Nedden (Germany) seconded the proposal, which was carried unanimously.

The chairman said the resolution would be passed on to the International Executive Committee to deal with.

M. Genissieu, speaking on behalf of France and several other Continental countries, expressed the view that international understanding would be efficiently assisted by the universal use of the metric system.

The chairman announced that appropriate telegrams had been sent to the Prince of Wales and the Earl of Derby expressing appreciation of their assistance with regard to the first World Power Conference.

This closed the morning session.

Mr. Hugo Hirst presided in the afternoon, when the representatives of all countries attending the Conference made short speeches expressing appreciation of their welcome, and admiration for the work that had been done and was to be continued in the future.

Mr. D. N. Dunlop announced, with regret, the death of Mr. B. G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Co., a delegate to the Conference and author of a paper. Mr. Dunlop added that he knew Mr. Lamme personally, and in his death they had lost a great electrical designer as well as a man of charming personality. He moved that a message of sympathy be sent to the relatives of Mr. Lamme in their great loss.

Dr. G. Semenza (Italy), who said that Mr. Lamme had always been a great friend to him, seconded the motion, which was carried by those present standing.

Mr. Hugo Hirst, in the course of a short opening speech, said the great object of the Conference was to develop the resources of the world for the purpose of producing cheap power; without cheap power they could not have cheap production in any form. The Conference, therefore, was something much greater and bigger than a conference of engineers. During the whole history of the world there had not been more conferences

than there had been during the past ten years, but the great distinction between other conferences and this first World Power Conference was that, whereas the others had looked backwards, this one was looking forward and aimed at something which, if carried through, would ensure the peace of the world, which was so much desired.

The outstanding feature of all the speeches made by the various delegates was an expression of hope and belief that the continuation of the International Power Conference would play an important part in maintaining the peace of the world. The representative of France offered a welcome to any of the delegates who visited the International Water-Power Exhibition at Grenoble next year, whilst a well-reasoned speech from the German delegate (Dr. Nedden), in which hopes were expressed for future peace throughout the world, was well received.

The chairman, in bringing the meeting to a close, expressed the hope that international goodwill and collaboration for the benefit of mankind would follow from the Conference.

Some of the Exhibits at Wembley.

The Western Electric Co., Ltd.

(Stand No. 15, Avenues 9 & 10, Bays 18—20.)

Upon this stand are many examples of power and telephone cables, both in sections and in tree formation. An example of power cable is the .25 sq. in., 3-core, 33,000-V cable manufactured and installed for the Borough of Woolwich, steel tape armoured and laid direct in the ground. This cable was tested in the works to a pressure of 75,000 volts between cores and 45,000 volts between cores and earth for 15 minutes. After laying and jointing, it successfully withstood 60,000 volts between cores, and 50,000 volts between cores and earth for the same period. Many other interesting sections are shown, and the cable exhibit is completed with examples of feeder pillars, joint boxes, and other power cable accessories.

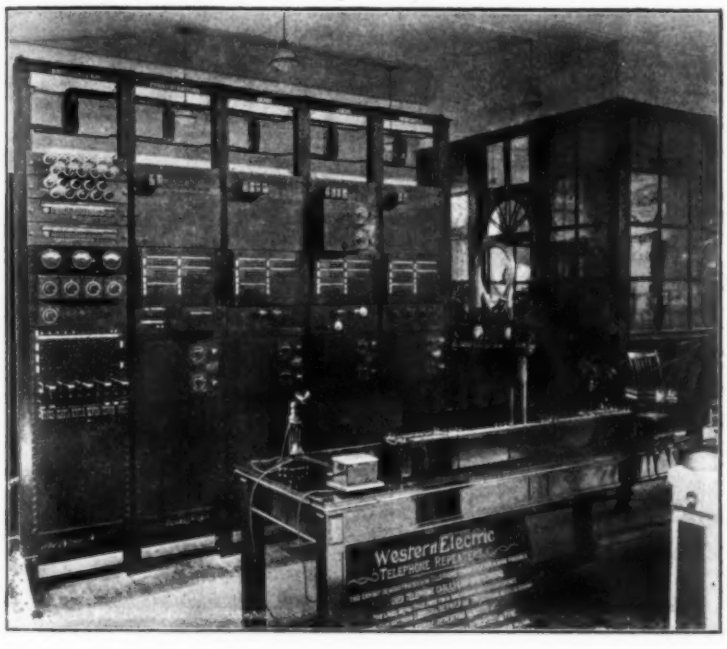


Fig. 192.—"Western Electric" Telephone Repeater Equipment.

Loading coils and similar apparatus is on view and, close by, a telephone repeater equipment (fig. 192).

This exhibit consists of a complete trunk telephone circuit with artificial cable representing over 100 miles of line. The repeater station is wired into the circuit, and is operated by means of switches so that visitors at the telephone are able to actually hear the decided improvement in transmission when the repeater is switched into the line.

A large array of telephones and kindred apparatus also appears. There are telephones for the home, the office, the works, the street, and the coal mine. There are central battery telephones, magneto instruments, exchange ringing sets, side station telephones and automatic telephones, as well as a comprehensive display of switchboards of various patterns. Methods of handling automatic to manual and manual to automatic calls are demonstrated.

The apparatus employed in the automatic switchboards is of a fairly simple nature, consisting of line and cut-off relays for each line, the selectors which automatically pick out the wanted line, and the sequence switches and associated relays which help to complete the connection.

The company's traffic control system is connected up for demonstration purposes. This system is in use on many of the most important railway systems in the world where, apart from the ordinary signalling, there is much to be done in the marshalling of goods and in the collection of reports, &c. The outstanding feature of the system is the "selector" device which enables the controller to select and ring exclusively any one out of as many as seventy-eight stations, all of which may be connected to one pair of wires running throughout the system. In addition, the controller can, if desired, give simultaneous instructions to all the stations under his control. The advantage of this system is that it can be arranged for the controller to have a moving model of the section in front of him, and every traffic movement can be so rapidly reported that the whole picture of the section is continually before his eyes. This system has also been adopted for tramways, and is at present in use by the Corporation of West Ham and the London County Council. Among the other items shown are printing telegraph perforators and transmitters, with which it is possible to transmit anything from 500 to 600 messages per hour. The radio exhibits include a complete range of the "Weconomy" receiving sets, all of which are

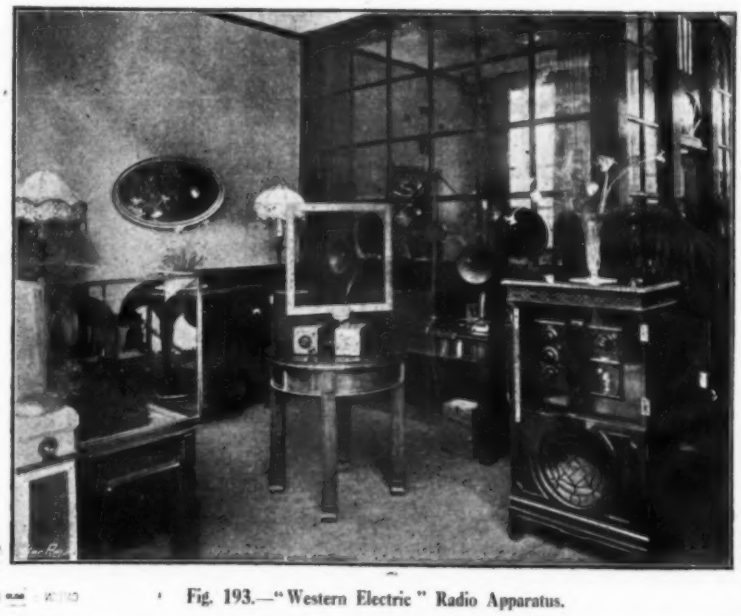


Fig. 193.—"Western Electric" Radio Apparatus.

designed on the "unit" system, so that it is possible to commence with any detector unit from the crystal set upwards, and by adding amplifiers, &c., build up complete equipments as required.

Loud speakers and equipments occupy an important position, and there is a choice of four designs. Two particularly choice models of Chippendale radio receiving cabinets are on view (see fig. 193). These ornate sets are completely self-contained. The larger of the two cabinets is provided with a seven-valve set, with a frame aerial. Point-to-point receiving and transmitting equipment is also shown.

British Insulated & Helsby Cables, Ltd.

(*Stand No.* 32, *Avenue* 10, *Bays* 18-20.)

Almost every type of cable made by the company is represented on this stand—from 60,000-V mains to telephone cords. The company's 33,000-V cables, and those for higher pressures, are well represented by six stepped-down samples over 28 in.

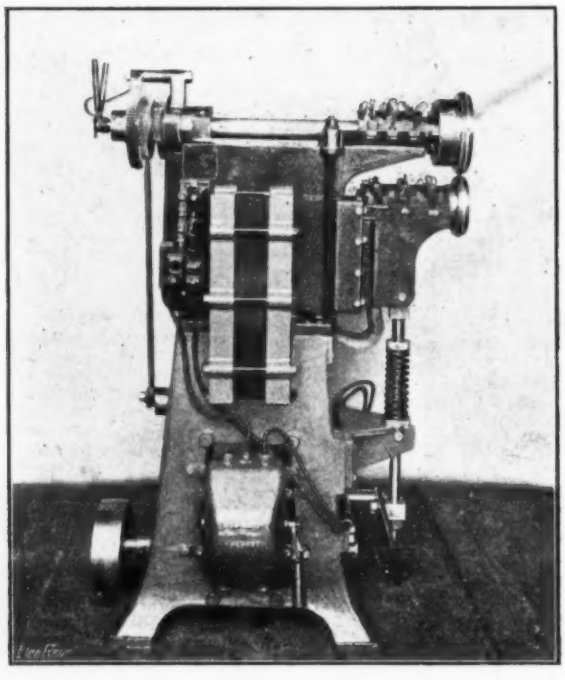


Fig. 194.—A "Prescot" Seam Welder.

long, while five sets of cable racks are filled with lower pressure and dry core cables. Small wires, such as flexibles, ignition cables, paper-insulated transformer wire, bell wires, &c., are arranged on reels mounted on revolving stands in such a manner that they serve both as exhibits and samples, provision being made for cutting samples from the reels. A typical drum occupies an important position. It contains a length of e.h.p. paper-insulated, single-wire-armoured cable. Glazed panels on the sides of the drum contain sets of cable samples.

The Wire Mill Department is well represented. Billets, a wire bar, rods, wires, sections, aluminium matting, copper and aluminium sheets, commutator bars, resin cored solder, &c., are shown. There is a set of sections showing the stages in rolling a wire bar down to ¼ in. rod. The enamelled wire exhibit takes the form of specimens of various wires and strands, together with articles in the manufacture of which enamelled wire is used, such as field coils, solenoids, telephone relays, and receiver bobbins. A wire-drawing machine and a diamond polishing machine are also shown.

The Helsby Works products include condensers, line materials, tools, exploders, &c. A cut-away tank condenser and a power-factor demonstration are items of interest.

"Prescot" pillars, boxes, overhead fittings, fans, and reactances demonstrate the versatility of the Electrical Fittings Department. In this section the *pièce de résistance* is a model electric railway.

We illustrate two of the welders which are on view. That shown in fig. 194, is a seam welder for a maximum load of 10 kW. The work is fed through the machine automatically, the electrodes are water cooled, and adjustments are provided for varying the speed of working. Fig. 195 illustrates a spot welder of similar construction, but with a greater length of "jaw" to accommodate long articles, as, for instance, drums or milk cans.

Another phase of the company's activities is typified by a number of paper pinions.

The "Helsby" twin wiring system is shown on arches at the two main entrances to the stand, with neat and effective

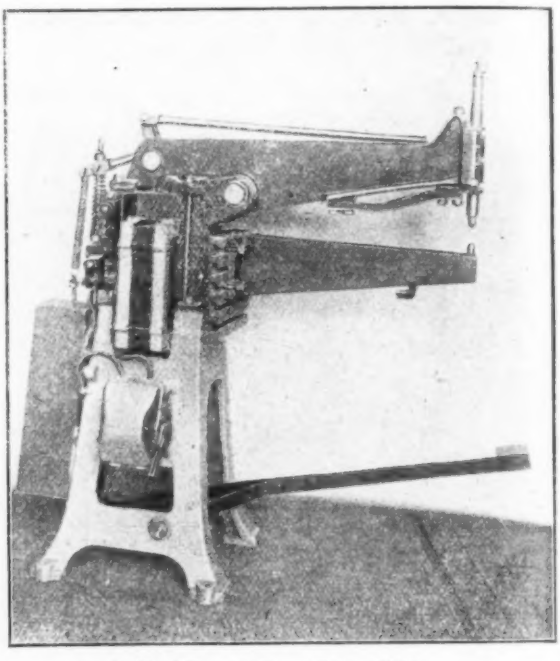


Fig. 195.—A "Prescot" Spot Welder.

illuminated panels across the top, samples of the wire and fittings being arranged on both sides of the pillars, and at the back and front.

The showcase containing lamps is very effective. Tungsten is shown in all stages from the powder to the filament, while a well arranged set of appliances and of parts in the various stages of manufacture illustrate clearly the sequence of processes in lamp manufacture. A "Helsby" aerial, complete with pole and fittings, spans the stand from front to back.

Messrs. Vickers-Petters, Ltd.

(*Stand No.* 1, *Avenue* 7, *Bays* 5-7).

Several examples of oil engines are exhibited by this company. One of these is a 168/180-b.h.p. four-cylinder engine direct-coupled to a 110-kW Metropolitan-Vickers generator (fig. 196), which provides electricity for lighting and power to supply the needs of the whole of the exhibits of Messrs. Vickers, Ltd., and their associated companies. Running in parallel with it is a 18/21-b.h.p. heavy oil engine built by their associated Yeovil firm. This is direct-coupled to a

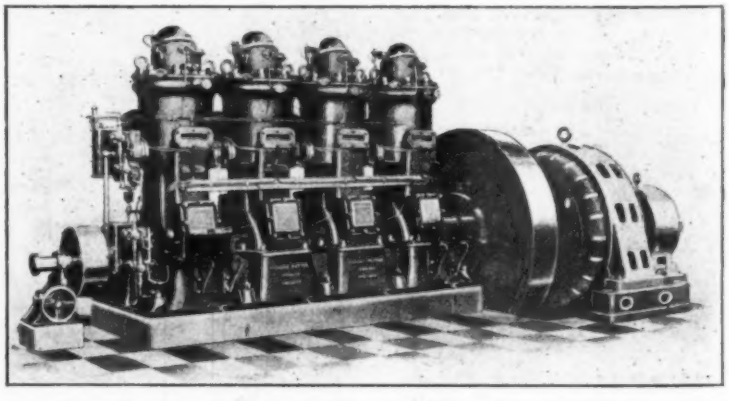


Fig. 196.—A Vickers-Petters Oil Engine and Metropolitan-Vickers Generator.

12-kW Metropolitan-Vickers dynamo. The whole of the plant comprising the power supply equipment in connection with these engines, including switchboard, wiring, &c., was made by Messrs. Vickers, Ltd., and their associated companies.

A third engine on the stand, which is available for demonstration purposes, is a four-cylinder Vickers-Petters marine engine of 90/100 b.h.p.

All Vickers-Petters engines are fitted with a patent light-load running device, by means of which the land engines can run on light or intermittent loads for indefinite periods, and the marine engines can be run dead slow for as long as necessary without having to light up the starting burners.

Other engines on the stand, but not in operation, are the following:—

One 22½/25-b.h.p. single-cylinder engine This is the smallest engine built by the company; a 28/30-b.h.p. engine; and an 80/85-b.h.p. single-cylinder engine. The last is the largest single-cylinder engine built by the firm. There is also an example of a two-cylinder engine, of 110/120 b.h.p.

In addition to the above there is a representative display of various component parts, including patent electrical starting apparatus and an electric starting torch. This torch consists of a protected element of high-resistance wire, which can be inserted by means of a screw operated by a hand-wheel into the combustion chamber in the line of the fuel spray. The wire is made red-hot by the current from the electric battery, and fires the first injections of the fuel, whereupon the current may be switched off and the heat of combustion keeps the wire hot enough to ensure ignition until the vaporiser itself has reached the requisite temperature.

Messrs. Babcock & Wilcox, Ltd.

(Stand No. 80, Avenues 11 and 12, Bays 23 and 24.)

This exhibit is composed of a number of models of the company's manufactures, of great interest to engineers, steam users, and those interested in labour-saving appliances for the economical handling of materials.

These include the Babcock & Wilcox patent marine type boiler, which may be arranged for either coal or oil firing. All pressure parts are constructed entirely of forged steel of the best quality, all tubes are straight, all joints are expanded, and all parts are easily accessible for cleaning and repair.

The Babcock & Wilcox patent marine type boiler (for land service) is shown. This, for the amount of steam generated, occupies less space than the standard land type. The marine type of boiler can be fitted with superposed economiser, and, in conjunction with a superheater and chain grate stoker, is enclosed in a wrought-steel casing, and forms a self-contained steam raising unit of the highest efficiency. This type of boiler has been supplied in units evaporating up to 150,000 lb. of water per hour. Other boiler models, &c., on view are the company's standard land type water-tube boiler, fitted with superheater and chain grate stoker; a patent oil fuel burner (pressure type) mounted on a furnace front and arranged to work with forced draught; a simple oil burner in which steam is used as the atomising agent; "Diamond" soot blowers for removing deposits of soot or ash from boiler tubes; various boiler parts, including a crossbox, a drum end with fittings mounted upon it, and a header with tubes expanded therein, all made of wrought steel, the tubes being of solid drawn mild steel; and a feed water regulator.

A gravity bucket conveyor model shows a typical conveyor installation comprising filler, driver, wheel curves, chain, and buckets.

Another model is that of a Babcock & Wilcox electric portal crane fitted with patent balanced lever luffing jib, which automatically moves the load horizontally, maintains the jib in perfect balance, and combines great speed and safety in luffing. It uses only a fraction, usually about one-twentieth, of the power ordinarily required to luff, and the gear is applicable to any kind of jib crane driven by any kind of motive power.

The Babcock & Wilcox patent self-dumping single-chain grab, as shown by a working model, is capable of handling various classes of coal, ballast, sand, grain, broken granite, &c., and also can be arranged for digging or dredging clay, sand or mud from under water.

The Babcock & Wilcox water flow recorder (Lassen's patent) which is shown provides a simple and effective means of metering and recording the amount of feed water passing into boilers, and at the same time gives a continuous chart of the rate of flow. The automatic water-softening plant (Lassen-Hjort system) is extremely simple in its working, and the arrangement for mixing the chemical re-agents with the water ensures reliable results. The apparatus works automatically, the supply of water to the softener being regulated by a float valve; and chemicals are added by a patent automatic measurer proportionately to the quantity of water flowing. A collection of various types of power-driven tube cleaners for removing incrustation from straight or curved tubes of boilers, economisers, evaporators, condensers, &c., by means of water, compressed air, steam, or electricity is exhibited, as are various samples of steam exhaust, feed, and other piping. In addition to the foregoing there are a CO_2 continuous indicator and recorder (W.R. patents), an illuminating reflex water gauge fitting, and a multi-gas burner (Razen, Schaefer & Co.'s patent) for steam raising and metallurgical purposes.

Electrical Energy from the Tides.

Details of an interesting French Experiment.

DURING the past century hundreds of patents have been taken out in respect of schemes to utilise the energy of sea tides, but so far no real solution of the problem has been found. It is therefore interesting to learn that an attempt is about to be made in France definitely to ascertain whether it is possible efficiently and at the same time economically to use tidal power in the generation of electrical energy. The effort is being made by a private undertaking—the Société Financière pour l'Industrie, of Paris—with the financial support of the French Government, a special Act having been passed to enable this to be done.

Of the various methods that have been devised to utilise tidal power, that which employs a double-acting reservoir has been adopted. With this system the plant is subject to two stops per 12 hours, during the periods of high and low tide. To permit of continuity of electricity generation, an auxiliary plant is necessary to work during the periods of idleness of the main plant and towards the end of the working periods when, owing to the relatively low head of water, very little power is exerted on the turbines.

Even when the system of water storage has been decided upon the problem is not solved, for the questions of variable height and volume delivery have to be taken into account. During one and the same tide the effective power, while the turbines are running, may vary from 1 to 4. Again, within a single week, between a neap tide of, say, 15 ft. and a high tide of 36 ft. the power may vary in the ratio of 1 to 10. Even if an approximate estimate be taken of an average fall of a third of the maximum amplitude of the tide, much will depend on the system selected and the method of running the electrical machinery. In certain cases it might be possible to rely on a full utilisation of two-thirds of the power available. It will therefore be appreciated that in view of such diverse theoretical conditions their solution can only be arrived at by a practical experiment on a large scale such as is now being undertaken in Finistère.

The three main difficulties to be overcome may be summarised as follows:—

(1) A turbine system similar to that utilised for waterfalls of a constant and regular character cannot, in the case of a tidal plant, be adopted off-hand, for experiments will require to be made in relation to variable falls both as to volume and height.

(2) A constant delivery speed not being possible, attention must be paid to the important question of the coupling of the generators and motors to secure running at constant frequency.

(3) Finally, there is a whole range of hydrodynamical and hydraulic problems to be studied, especially with regard to phenomena hitherto unapproached, among which may be mentioned the effects of currents and eddies near the plant, which can only be examined through the medium of barrages of ample dimensions.

It is largely the desire to secure a solution of the foregoing problems that has led the French Government to participate in the Aber Vrac'h installation, for the following particulars of which we are indebted to our contemporary *L'Electricien*. The selection of this particular part of the Finistère coast for the purpose of the experiment was mainly based on the fact that it fulfils the following conditions:—

(*a*) That while on a sufficiently large scale, it shall not be too costly.

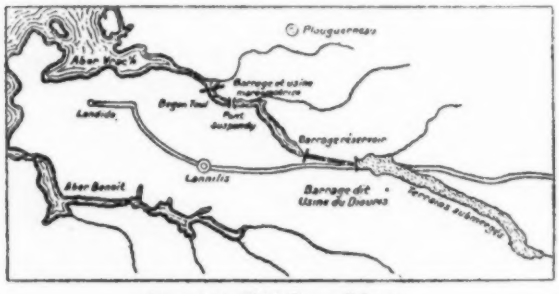
(*b*) That it shall not be too far away from suitable centres of energy consumption.

(*c*) That tides of sufficient amplitude shall be available.

The installation will comprise a tide-operated station near Port de Paluden (Lannilis), an auxiliary station on the River Diouris with barrage-reservoir, and a 30,000-V transmission line to the important town of Brest. The work at the tide-operated station in the estuary will include a barrage, 492 ft. long and from 39 to 58½ ft. in width; it will comprise three ferro-concrete caissons, the central one of which will be furnished with four turbine chambers, while the other two, located symmetrically on each side, will accommodate the sluices and their operating mechanism. A masonry wall will connect the reservoirs with the land abutting on the estuary, while in order to permit the passage of vessels at high tide a 33-ft. gate working very much on the lines of a lock and capable of opposing both the flood and ebb tides, will be provided.

The barrage will extend right across the estuary, dividing it into two parts, the inland portion, according to the height of the tide, being able to store from 3,300,000,000 to 10,500,000,000 gallons of water. Four turbines, each of a variable output ranging from 75 to 1,200 h.p., will be operated by means of this double-acting basin and will drive asynchronous alternators. The turbines will be provided with two-speed gear ratios, the frequency being maintained constant by a concomitant variation of the number of poles of the generators, and the change-speed gear only utilised to augment the speed of rotation of the electrical machines and thereby to reduce the cost of running or effect a reduction in their size. The period of running of the main plant will vary from 9 to 11 hours per tide of 12 hours. A special chamber is to be provided in the barrage to serve as a hydro-technical laboratory and also to allow of tests of different forms of turbine.

The auxiliary station, about 3¼ miles up the River Diouris,



Plan of the Tidal Power Scheme.

will be operated by fresh water and will act as a controlling plant to provide for the continuous operation of the installation as a whole. It will be connected with the main station electrically and will be located on a barrage which will have a height of 115 ft. and embody a weir or overflow capable of delivering about 3,080 gallons per second.

The water accumulated behind this barrage will overflow the banks of the river and the effect will be felt for a distance of 4½ miles on the inland side. In some parts the land will be submerged to a width of 1¼ miles, the reservoir thus formed having a capacity of approximately 2,400,000,000 gallons.

The auxiliary station plant will comprise: (1) Two or three groups consisting of (*a*) a horizontal-shaft turbine capable of developing 2,700 h.p., with a head of 95 ft., and 1,200 h.p. at 49 ft.; (*b*) an asynchronous alternator; (*c*) a centrifugal pump delivering water at a constant volume proportionately to the available power; (2) two auxiliary groups of 100 h.p., each comprising a turbine and synchronous alternator—one of the latter will be used to fix the periodicity of the main current while the other will provide the wattless current necessary for the operation of the asynchronous generators at the two stations; (3) two 1,500-h.p. pumps operated by electric motors; and (4) a group of two pumps requiring a maximum of 3,200 h.p., which will be put into operation at the moment when there is a superabundance of power at the tidal station, drawing water from an auxiliary reservoir below the works and pumping it into the barrage reservoir, in order to re-establish the reserve of fresh water. This secondary reservoir will be 478 ft. long and have a capacity of roundly 106,000,000 gallons; it will be located between the Diouris station and a watertight bank which will, however, be pierced by an aqueduct capable of being opened and closed as desired and, when open, of delivering 3,080 gallons per second from the weir or overflow of the barrage.

The projected transmission line to the town of Brest will be an ordinary 30,000-V line connected up to both main and auxiliary stations. During the period of non-running at the tidal station, and during certain neap tides, the turbines at the auxiliary plant will operate their respective generators and so furnish the necessary current. As soon as the tide-power station is in operation and takes up the load, all the plant at Diouris will be stopped, step by step, with the exception of the 100-h.p. set serving to determine the periodicity. Finally, when the power at the tidal station becomes superabundant, the alternators at Diouris will be set to work as motors to drive the pumps.

As a result of the combined working of the two plants it is expected that a maximum of 3,200 h.p. and a minimum of 1,600 h.p. will be attained, and that the annual output will amount to 11 million kilowatt-hours—7 millions from the tidal plant and 4 millions from the auxiliary station. It is further estimated that the cost of production will not exceed 3½ centimes per kilowatt-hour. The concessionnaire company is only estimating on the town of Brest taking 5½ million kilowatt-hours a year, but with an important contract for supplying the Brest Arsenal it is reckoned that an annual sale of 6 million kilowatt-hours may be relied upon from the commencement of operations. Energy will be supplied to Brest at 25 centimes per kWh and at a slightly lower rate to the Arsenal, so that if anticipations are realised, there should be ample scope for liberal profit. There are many problems to be overcome, possibly some of an unanticipated character, but even should the Aber Vrac'h experiment not prove a success, it will certainly provide all interested in the problem of the utilisation of tidal power with valuable data.

C.J.W.

Comparative Water Power Development in Canada and the United States.

(Communicated.)

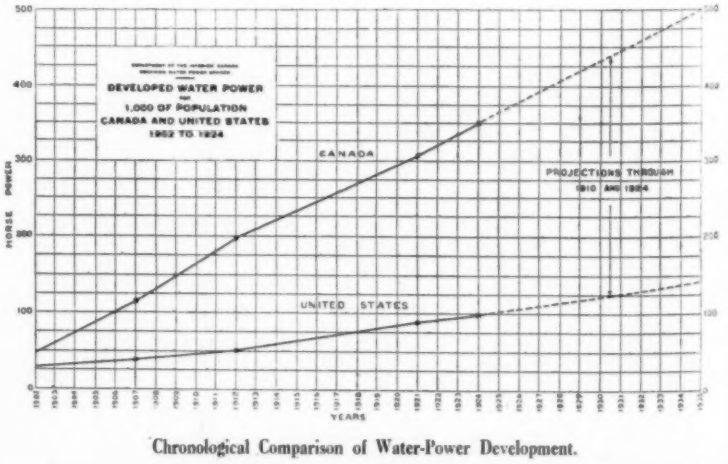
Developed Power in the United States.

Present Rate of Progress.—In the last two or three years there has been great activity in applications for licences under the Federal Water Power Act of June 10th, 1920. An interim report to November 1st, 1923, shows 317 active applications, totalling 12,700,000 h.p. available 90 per cent. of the time, and an estimated ultimate installation of 22,270,000 h.p.* It also states that the developments now *under actual construction* under licences from the Commission involve a proposed ultimate installation of 2,399,000 h.p.

The above implies very large and rapid development. An analysis† of this 2,399,000 h.p. shows, however, that 186,000 h.p. was scheduled to be put in operation in 1923, 261,000 in 1924, and 142,000 in 1925—a total of 589,000 h.p. in three years. It appears, therefore, that actual construction under the Federal Power Commission's licences is not proceeding at quite so rapid a rate as would appear at first sight.

There are also many developments under construction which come under the jurisdiction of the individual States and not, or not entirely, under that of the Federal Power Commission. No official information concerning these is available, but information almost equally reliable is contained in the compilations made by the *Electrical World*.

A recent detailed table‡ of such developments *actually under construction* in January, 1924, and specified as additional to those licensed by the Federal Power Commission, shows 77 plants, totalling 2,045,000 h.p. This is initial h.p., the ultimate being shown separately when available. The table shows every evidence of being prepared with care and reliability.


DEVELOPED WATER POWER PER 1,000 OF POPULATION CANADA AND UNITED STATES 1902 TO 1924
CANADA
UNITED STATES
PROJECTIONS THROUGH 1910 AND 1924
HORSE POWER
YEARS

Chronological Comparison of Water-Power Development.

Installed H.p.—The latest complete official figure is that for 1921, 9,243,000 h.p.* The *Electrical World* of January 6th, 1923, placed it at 9,540,000 h.p.

Power of January 1st, 1924, gives particulars of plants of

* *Electrical World*, January 5th, 1924, page 27.
† *Ibid*, page 28.
‡ *Ibid*, page 29.

* World Atlas of Commercial Geology. Part II, Water Power of the World.

10,000 h.p. or over which were completed or nearly completed during 1923; these total 831,700 h.p., and, adding 10 per cent. for smaller plants, the figure becomes 915,000 h.p. It is believed that, adding this to the *Electrical World's* above-quoted estimate of 9,540,000 h.p. will give a conservative estimate of the total. *The installed h.p.* at January, 1924, is therefore estimated at 10,455,000 h.p.

Under construction, January 1st, 1924, and to be completed in, say, two years, as detailed above :—

Federal Power Commission licences ...	403,000 h.p.
Other undertakings, initial h.p. ...	2,045,000 h.p.
Total	2,448,000 h.p.

Developed Power in Canada.

At January 1st, 1924, the installed turbine h.p. in Canada was 3,227,414*, and there was under construction, and expected to be installed in two years, 900,000 h.p.†

Comparison of United States and Canada.

To compare on a *per capita* basis, the population as at January 1st, 1924, has been estimated on exactly the same basis for both countries—the figure of the last census plus the average annual increase during the past decade for the intervening years.

Chronological Comparison.

	United States			Canada		
	Population	H.P. Installed		Population	H.P. Installed	
		Total	Per 1,000		Total	Per 1,000
1912	—	4,870,320‡	51·0*	7,343,000†	1,450,000	198
1921	107,085 000	9,243 000§	86·3	8,788,000	2,680,000	305
1924	109,842,000	10.455.000	95·0	9.184,000	3 227,000	350

* Electric Power Development in the United States. Senate Document 316, Page 26.
† Canada Year Book 1919, Page 491.
‡ Senate Document 316, p. 28.
§ Water Power of the World. Washington, 1921.

The situation which the above table establishes is much more readily grasped from the accompanying diagram, and from the latter it will be seen that in water power development *per capita* Canada has up to the present time steadily increased her lead.

Turbine H.P. Installed, January 1st, 1924.

	United States.	Canada.	Canada greater by
1. Installed	10,455,000	3,227,414	
Per 1,000 of population	95	350	268%
2. Under construction ...	2,448,000	900,000	
Per 1,000 of population	23	98	326%
3. Totals of 1 and 2 ...	12,903,000	4,127,414	
Per 1,000 of population	118	449	280%

Water Power v. Fuel Power in the United States.

In the competition between water and fuel power in the United States water power does not yet appear to be making any progress, though the large amount of hydro-electric development now taking place in the Western States may change the situation in the future. The proportion of output of central stations furnished by water power was, in 1919, 37.5 per cent., and in 1923 35.1 per cent.

Additions and extensions by central stations during the last three years are as follows :—

	Steam Plants.	*Hydro-electric Plants.*	
	Amount.	Amount.	% of total.
1921	$49,858,000	$45,808,000	48%
1922	100,543,000	63,790,000	39%
1923	209,417,000	74,396,000	26%

This, however, is not remarkable when it is remembered that cheap and abundant coal is available in the principal manufacturing area of the U.S., and that the consumption of coal per kWh in large plants has decreased during the last 20 years from 12 or 15 lb. to 2 or 3 lb., or even less.

Conclusions.

While the figures published by the technical and other Press of impending hydro-electric developments in the United States are imposing in their magnitude, it does not appear that, considered in relation to a population now about 110,000,000, and using about 60,000,000 h.p. (not including steam railroads), they are in any way abnormal, nor that they will cause any great change in the near future in the lead Canada holds in developed horse-power per head.

*Report No. 722, page 1.
†Report No. 712, page 1.

The National Physical Laboratory.

Annual Report.—*(Abstract.)*

The annual report of the National Physical Laboratory indicates that the year 1923 was characterised by a steady growth of work in all departments, mainly due to the demands made upon the Laboratory from outside, and in particular to the requirements of other Government Departments, submitted through the Co-ordinating Research Boards of the Department of Scientific and Industrial Research. There was a slight falling off in work for firms, as compared with the preceding year, but towards the end of the year this work showed a tendency to recovery. The growth of the work has necessitated increases in the staff in nearly all departments. In the physics and metallurgy departments the pressure has been especially marked, and the difficulties of accommodation are becoming seriously felt. The need of a suitable physics building is becoming each year more urgent.

The total number of tests carried out in all departments during the year was 696,180, or a reduction of 113,922 on the previous year's total. In the electricity department the number of tests amounted to 1,975, as compared with 2,191 in 1922.

Plans have been prepared by H.M. Office of Works for the provision of a building and equipment suitable for investigations at a pressure of one million volts to earth.

Maintenance of standards constitutes one of the primary and most important functions of the Laboratory. An investigation into the use of a wave-length of light as a standard of length has been included in the Laboratory programme for the current year, and more recently the Laboratory has been in consultation with the Bureau of Standards and the Physikalisch-Technische Reichsanstalt with regard to a possible basis for an international scale of temperature. The Reichsanstalt has also suggested that, in view of the discovery of isotopes of mercury of differing density, it might become necessary to include in the definition of the international ohm a value for the density of the mercury to be used; it may be sufficient to specify the use of "natural" mercury in the definition.

Satisfactory progress has been made during the year with work on the fundamental electrical standards. Work on the new Schuster-Smith magnetometer is also well advanced, and the improvements effected by Mr. Dye in the methods of measurement of radio-frequency and wave-length are of considerable importance. The multi-vibrator wavemeter as now employed for frequency measurements enables an accuracy within a few parts in 100,000 to be obtained, and provides a standard of high precision and of wide application. The work was undertaken at the request of the Radio Research Board to secure apparatus suitable for use in the services. Assistance has been given in the provision of a wavemeter for the use of the radio-telegraph branch of the Canadian Department of Marine and Fisheries, and at the request of the Australian Government the Laboratory has undertaken to advise in the construction of a multi-vibrator wavemeter set similar to that set up in the Laboratory for the use of Amalgamated Wireless (Australasia), Ltd.

Much work has been done in the Photometry Division of the Electrotechnics Department with a view to providing suitable standards for the photometry of electric lamps of high luminous efficiency and to laying down a satisfactory basis for the comparison of the luminosity of light sources of different spectral composition. This question will be considered at the meeting of the International Illumination Commission to be held at Geneva in July, 1924.

Government research under the Department of Scientific and Industrial Research has greatly increased during the year under review, and a further considerable increase is anticipated during 1924-25.

The cost of the research carried out for the Air Ministry, the Admiralty, and the War Office is borne by those departments. Payment is also received for test work and investigations, not of the nature of research, carried out to the immediate requirements of other Civil Departments of State.

At the present time approximately one-third of the income of the Laboratory is derived from tests and investigations carried out for firms and outside bodies; if paid work for Government Departments be included, the work for which payment is received amounts to more than half the total income. Approval tests of meters, carried out on behalf of the Electricity Commissioners, have shown an increase; and there has been a steady growth in the work of testing hospital X-ray installations throughout the country.

The Physics Department.

A large amount of equipment obtained during the year has added very materially to the resources of the Department, and the section dealing with electroplating has proved of great value.

The work of the Radiology Division on X-ray protection in association with the Protection Committee has resulted in alterations and additions being made to the Protection Committee's recommendations. The year records a definite commencement of work on atomic physics, including X-ray spectrometric investigations of the structure of metals and researches on the thermal and electrical conductivities of individual metal crystals. The construction of all-metal mercury vapour vacuum pumps is approaching completion.

The heterochromatic photometry investigation aims at the calibration of tungsten-filament lamps as standards of spectral distribution of visible radiation. It is proposed to calibrate the lamps by comparison with the radiation from a black-body carbon-tube furnace held at various temperatures up to 2,500 deg. C. A determination of the thermal conductivity at high temperatures of aluminium, copper, magnesium, nickel and zinc is on the point of completion. The opportunity has also been taken of measuring the electrical conductivities at high temperatures of the same specimens, so as to obtain the relation between the two conductivities.

An investigation on the scattering of gamma-rays by matter was undertaken with a new spherical ionisation chamber and the analysis of the absorption curves shows that in the case of light elements there is pure scattering and true absorption, both of which are proportional to the atomic number. In the heavier elements a fluorescent absorption, which is proportional to the fourth power of the atomic number, as in X-rays, is also evident. Materials have been examined for their X-ray protective values, and the report includes a table showing the density and the lead equivalent of a variety of materials. A knowledge of the protective value of building materials will probably be of service when buildings intended for radiological purposes are being erected.

A new generator has been presented to the Laboratory by Messrs. Watson & Sons (Electro-Medical), Ltd. It is of the induction coil type, and is capable of generating 250,000 volts (peak) on open circuit, 5 milliamperes at 227,000 volts (peak), or 38 milliamperes at 125,000 volts (peak). Apparatus has been permanently set up for the spluttering of surfaces with different metals by the cathode-ray method. It was primarily constructed to coat glass plates with a semi-transparent layer of silver.

The radium tests in the Radiology Division have been further improved by the addition of a test for leakage, and progress has been made with a number of interesting researches, including an investigation into the scattering of gamma rays by matter, the excitation of X-ray bulbs by different generators, the relation between total and "local" ionisation, the scattering of cathode particles when allowed to fall on different substances, and the structure of metallic crystals. Work has been done in the radiographic examination of materials for various purposes.

The work of the Sound Division has so far been mainly the provision of the necessary equipment for future work.

Electricity Department.

In the Electrical Standards Division, in addition to the fundamental work on standards a considerable amount of subsidiary work relating to standard methods of measurement has been carried out. Measurements of the phase angle for different methods of connection of mutual inductances have been made, leading to conclusions of importance for accurate work. In connection with methods of measuring radio frequency, experiments have been conducted on the use of the quartz plate resonator; it would appear that this method will have many useful applications. An investigation has been made into methods of producing small radio-frequency voltages, and equipment is under construction for precision measurements of radio-frequency current. Methods of measuring the effective resistance of coils at radio-frequencies have been examined. Some work on dielectrics has been carried out for the British Electrical and Allied Industries Research Association, and a report on existing knowledge on the subject of power losses in dielectrics is in preparation for the Association. A considerable number of tests of transformer sheets for hysteresis and eddy current losses have been made, and important results have been obtained with regard to the losses at high inductions.

In the Wireless Division, work on direction-finding has been in progress since 1921. Research on amplification and amplifier design has been commenced. Measurements of equivalent decrement of various types of wireless transmission are in progress, and experiments on intervalve transformers have been undertaken.

The Electrotechnics Division continues to be much occupied with test work, and in the alternating current section, especially, with the perfection of instruments required in modern practice for standard measurements at the higher voltages. Additional motor-generator equipment has been installed, and experiments are in progress on methods of measurement of small amounts of power at high voltages, in connection with tests of insulating materials, and an experimental instrument has been constructed for measurements of the amount of energy evolved in breaking electrical circuits.

In the direct current section the important work on buried cables has been continued for the British Electrical and Allied Industries Research Association, supplementary to that published in the report issued last year by the Association. Experiments on the resistance of porcelain at high temperatures have also been proceeding. The research programme of the section includes work on resistance materials, and on the earthing of electrical circuits. Investigations have also been carried out relative to the current rating of copper and aluminium bus-bars, and of low pressure, single-conductor, lead-covered cables, and on the fusing and safe running currents for different fuse metals.

Engineering Department.

Tests have been undertaken in order to discover a suitable preventive of rust on the steel parts of stored machinery. In general grease-coated test-pieces are superior to those coated with drying enamels, such as resin and bitumen. The latter appear to be liable to crack and allow rusting under the cracks, although no trouble has been experienced with the materials flaking off. The success of the preparations depends upon the method of covering the test-piece. It is difficult to ensure that greases, when applied with a brush, will adhere to the entire surface, and rusting will occur under the grease at any faulty places, although they are bridged over by a film of the grease. Grease deposited from a readily-vaporised solution will adhere with certainty, but solvents of grease are not easily found.

A third series of tests has been made upon heavy oils for working at high pressure, speed, and temperature. Thirteen oils have been examined; two or three of them have been successful in running at a pressure of 1,000 lb. per sq. in. at a temperature of 180 deg. C. (=336 deg. F.), while one has run at this load at 200 deg. C. (=392 deg. F.) without seizure. Most of the oils are of the type used in motor car engines, and the tests show the reason for the great improvement in efficiency of small engines when thoroughly warm. The reduction in friction between 50 and 100 deg. C. amounts to from 50 to 70 per cent., that is to say, the frictional loss in engine bearings is less than one-half, if the oil is kept at about the boiling point of water. It is, therefore, clear that it is possible to over-cool the oil supply so that such engines can never give their best performance.

Metallurgy Department.

At first sight it would appear that the Ajax-Northrup high-frequency furnace furnishes an ideally simple method of producing any desired alloy by fusion *in vacuo* with the complete avoidance of contamination. Actually, however, considerable difficulties arise in its practical use. One of these, which would not have been anticipated at first sight, lies in the fact that the rate of heating of a metallic charge in this furnace is extremely rapid unless special means are used to reduce it. The consequence is that crucibles and tubes are easily cracked by the excessively rapid expansion. This can to some extent be remedied by the somewhat unsatisfactory method of interrupting the supply of energy at frequent intervals in the early stages of the heating process. A further difficulty lies in the fact that there appears to be some trouble in melting down the topmost layer of any charge of metal introduced into this furnace. While heat is generated probably to an almost equal extent throughout the mass of the charge, the surface layer loses heat rapidly by radiation. The consequence is that long before the surface layer has melted the bulk of the charge is not only melted down, but becomes considerably superheated. Great care is therefore required to avoid melting through the crucibles and containers at a stage when apparently the charge has not yet gone down completely. There is a corresponding difficulty in avoiding surface solidification of the molten metal after the heat supply is discontinued, thus leading to the formation of large hollow cavities in the ingots left in the crucible at the end of the operation.

With regard to the supply of adequately pure materials for the production of alloys for research, reference was made in last year's report to the necessity of preparing in the Laboratory, by electrolytic means, an adequate supply of pure iron. Similar means have now been adopted for the preparation of both chromium and manganese. Molten iron and iron-oxide form two liquid layers, but in the majority of refractory containing-vessels the layer of molten iron oxide is rapidly and completely absorbed. Crucibles of magnesia, however highly shrunk, made by ordinary processes of pressing and firing, are still unsatisfactory for the retention of iron-oxide. A process has, however, been developed whereby the interior surface of a small magnesia crucible is fused by the action of a powerful electric arc. The surface thus

rendered impervious, is found to resist the attack of iron-oxide to a satisfactory extent. Thanks to this development it has been possible to proceed with the investigation of the iron-iron-oxide system of alloys. The very considerable difficulty of obtaining satisfactory chemical determination of the oxygen content of such alloys when containing appreciably more than 0.1 per cent. of oxygen, has now been overcome.

Research work on magnet steels has been completed during the year under review, and a full report has been presented to the Physics Co-ordinating Research Board. The results indicate that it is not possible to arrive at any general conclusion concerning the composition, constitution, and heat treatment of magnet steels unless a very much more extensive survey of iron alloys from this point of view is undertaken.

Conditions in Austria.

THE record of Austrian conditions during 1923, under the *ægis* of the League of Nations, contained in a recent report sent to the Department of Overseas Trade by Mr. O. S. Phillpotts, O.B.E., Commercial Secretary to the British Legation at Vienna,* is one of an improvement surpassing all expectations. The State Budget deficits have reached manageable proportions and the political conditions have been generally favourable. The commercial position has not progressed so well, several failures having occurred through a financial crisis in the early part of the current year. Nevertheless, the amount of employment showed an increase. The effects of the financial trouble above referred to are expected to be felt for some time, and another adverse factor to be taken into account in reviewing the prospects for the current year is the probability of a lessening of the advantage to Austrian trade caused by the French occupation of the Ruhr, which practically eliminated German competition. It is hoped that the State finances will not require further assistance from the League of Nations after the end of this year, and it is suggested that the balance of the amount of the loan set aside for this purpose, which will remain in the hands of the League's High Commissioner, should be devoted to the financing of water-power projects and other public works, as well as to the assistance of industry.

Water Power and Electrification.

The decline of 15 per cent. in the coal and coke consumption is attributed chiefly to the unemployment in a number of industries, but it is thought that the increasing use of hydro-electric power may be partly responsible. Water-power development has proceeded, and at least two of the provincial water-power schemes have managed to obtain foreign capital during the last six months. The Styrian company "Steweag" has secured the participation of Italian financiers, it is believed on the understanding that some of the orders for equipment will go to Italian manufacturers, and a substantial credit from London and New York financiers has been obtained for the scheme of the province of Salzburg. Probably more foreign financial assistance could be obtained for these and other undertakings if the Austrian companies, generally, would realise that the easiest method of getting it is to give orders abroad. The eagerness to start new water-power works has fallen off since 1921. According to official statistics, works of 94,700 h.p. were begun in that year, 59,100 h.p. in 1922, and 23,300 h.p. in 1923, making a total of 186,000 h.p. (mean), 13 works of a total capacity of 19,400 h.p. were completed in 1922, and 5 of 15,900 h.p. in 1923. It is expected that a large number of stations will commence delivering electricity in 1924 if sufficient funds for their completion are available.

The electrification of the State railways in the west of Austria advanced so far that electric traffic began on the Arlberg route between Innsbruck and Landeck in the autumn. It is expected that this traffic will be extended as far as Bludenz in Vorarlberg by the end of 1924 and to Buchs on the Swiss frontier in 1925. On the other line being electrified, the part between Atnang and Steinach-Irdning will be completed earlier. In January, 1924, the first of the new powerful electric goods locomotives for the severe gradients was completed. Twenty of these are to be completed before the end of 1924; like the other electric locomotives they are all being constructed in the country. The completion of the railway electrification has been made possible by the advance, by the High Commissioner, of about £2,500,000 (42 million gold crowns) out of the League of Nations loans.

Industry and Production.

The Austrian iron industry benefited considerably by the occupation of the Ruhr. The adverse effects upon industry of the stabilisation of the crown in 1922 continued during the year, but with diminished force, and there was a reduction in the number of unemployed. Another industry which profited from the Ruhr "sanctions" was engineering. The firms producing electrical machinery have done well owing to the development of water-power in Austria, and they are looking forward to a boom in broadcasting apparatus.

A certain amount of stagnation in the Austrian manufacturing industries is likely to last for a long time, as they suffer from the loss both of nine-tenths of their old protected markets and of the preferential railway rates they enjoyed over a wide area before the war. Shortage of working capital, very high rates of interest on money borrowed, the obstacles placed in the way of exports to their natural markets, and the poverty of a large part of the Austrian population, are further handicaps as compared with pre-war conditions. Altogether these are sufficient to cause a prolonged period of depression without attributing it mainly to high taxation, social burdens and wages, as is frequently done here. The Austrian industries will not recover their pre-war prosperity unless and until they are reorganised to meet foreign competition and can find new markets, but this will require both capital and time.

*Stationery Office, 1s. 6d. net.

Radio-Telegraphy and Telephony.

In January, 1924, a radio-telegraphic service with foreign countries, including the United Kingdom, was started by an Austrian undertaking with a State concession. Marconi's Wireless Telegraph Co., London, holds more than half the shares and provided all the electrical part of the equipment. The Austrian Government received the greater part of the rest of the capital in return for the radio masts and buildings of its two stations near Vienna.

An Austrian company, but as now planned without foreign participation, will be formed in the course of 1924 to carry on radio telephony and broadcasting within Austria. According to present arrangements the Austrian Government, the Municipality of Vienna, and a credit institution in which the Government is interested will have a majority of the shares, and the rest will be subscribed by a Styrian bank and Austrian firms manufacturing electrical apparatus. A law regulating broadcasting is in preparation; it is stated that licences will only be granted for apparatus made in Austria, but in view of the considerable quantity that has recently been imported there will probably be some relaxation of this rule.

Foreign Trade.

During 1923 the value of imports rose to £77,122,000, while exports fell to £43,238,000—an "unfavourable" balance of £33,884,000. A large trade is done with neighbouring States; Jugo-Slavia was the greatest importer of Austrian goods, while Czecho-Slovakia exported most to Austria. The United Kingdom share of imports into Austria remained at 2.4 per cent.; our imports from Austria increased from 3.5 to 4.2 per cent. An appendix to the report shows that in 1923 Austria imported "electrical machines, apparatus, and parts thereof" to the extent of £663,000 (4,539 metric tons); the bulk of this came from Germany, and the United Kingdom supplied only seven metric tons. This, however, was an improvement, as only one ton was supplied by this country in 1922. The export figures are more detailed. Under the general heading "Electrotechnical machines, apparatus, and electrotechnical articles" the exports are given as 9,096 metric tons, valued at £1,636,000. Most of this went to Germany, but the United Kingdom is shown to have taken 530 tons. The largest separate class for which figures are given is electric lamps—2,481 tons (£652,000)—this country having received 324 tons. We were the largest importers of Austrian carbons for electrical purposes, taking 53 tons out of a total of 93 tons, valued at £11,000.

British Capital in Austria.

Probably the chief British interest in Austria is financial, that is to say, the value of the British investments made in and of credits given to Austria in a year is probably greater than the value of our exports to Austria. The best way to increase the sale of British goods in Austria would be to combine it with finance. Owing to the shortage of capital in Austria, schemes for obtaining British credits for manufactures, banks, local authorities, railway and mining and water power undertakings are continually being submitted to British financiers, and anyone in Vienna who is thought to be in communication with them. Most of these proposals come to nothing for various reasons. Would-be borrowers here are now willing to devote at least part of credits to the purchase of British goods, if they cannot get the credits otherwise, but until recently they would not listen to this suggestion when similar goods were also made in Austria. A contract to buy British goods, of course, would make it easier to raise money in London for Austrian undertakings. Credits given to or through Austrian banks (apart from acceptance credits) seldom lead directly to orders for finished goods from the United Kingdom as the banks are all themselves interested in Austrian manufacturing concerns.

The general and economic situation is explained at some length in the report because British finance has already taken a considerable interest in Austria with results which, on the whole, have been satisfactory to both sides, and it is largely to London that Austrians look for further assistance. The extension of British trade is only possible with the co-operation of British finance. With its traditions and connections Austria affords in the future, as in the past, a fruitful field for the activities of British commerce and finance.

The Sales Representative.

By FREDERICK W. POPE.

There are some travellers to whom one feels bound to give an order. They have a way with them which is almost impossible to resist. They talk in such a good-natured easy-going manner, and if one is young and impressionable they frequently "get over" on their personality alone.

One is not thinking of those gushing individuals who have little intelligence beyond telling the right kind of joke at the right time and would promise anything to get your order.

No! There are a great number of sales travellers whom it is a pleasure to meet and to talk to, and who may call time after time without success, yet still carry their disappointment away with a jolly remark about cricket or the weather. On fine days, you envy them their outdoor occupation; on wet days you wonder what it is like to go from place to place as they do, with varying results. If you asked one of them to give you some notion of how new business is obtained and kept, it is not certain that he would be able to give you a clear idea. Many would, of course, but it is so much a matter of personality that method is secondary. You could not imagine the really successful traveller telling you that his success was the outcome of a course of salesmanship. Orders do not come out of formulæ.

Nor do they come to the man who is not invariably truthful. "Truth in Advertising" is a slogan which applies equally to a firm's personal advertiser as to its newspaper and poster field. Perhaps this is more a question of exaggeration than of direct lying, but who is going to measure the exact degree of inaccuracy? If you have not told the whole truth, your customer will not be long in finding out. The delivery date, for instance, is not always honoured as part of the contract. It might be admitted that the temptation is great when an order is offered on a strict condition of delivery. Is the canvasser justified in taking the order when he knows quite well that the delivery specified cannot possibly be given? Even here, as part of a truthful policy, his personality can make the best of what appears a hopeless task. Two men may be canvassing for particular business: the first may promise the best efforts of his firm to deliver as near date as possible, the second may make a definite promise a little too glibly, and there are few buyers who would not appreciate the subtle difference. Then there is always future business to consider. What kind of connection are you making? That is the ultimate point to which all this comes.

Although method is secondary, it is too important to be neglected. Every "commercial" ought to know those firms which resent frequent and persistent calling, against others who admire and eventually reward it. Some firms will desire an advance intimation of your coming. It is essential that you should acquaint yourself with any peculiarity which is likely to affect you.

The manner in which you introduce your business will depend upon yourself. It is unlikely that you will say "This is nothing in your line, is it Sir?" Though you may smile incredulously, this form of introduction has been used on at least one occasion. There are many others akin to it, and the traveller who smiles indulgently when he hears that one is buying from a competitor of his, is not far removed. "How innocent you are!" seems to be his unspoken thought.

It has been presumed all along that you are travelling in a sound and competitive line, one that needs all that a good line should need—a courteous and persevering introduction. Goods that will not live up to their vendor's representation will carry failure in the first consignment. Any further comment on this aspect would take the present question out of bounds.

Is it essential that a sales representative should have some practical or technical knowledge of the trade with which he is concerned? In some trades this would be impracticable, but to confine the question to the engineering trade, one might reply that such knowledge is, in some branches, essential, while in others where it is not absolutely necessary, it is, nevertheless, a big asset. This must, of course, be qualified by the earlier comments on personality.

The sales representative leaves an impression in the minds of the people he calls upon. If this impression is consistently good, he may feel sure that success, even though it be delayed, will come. Condensed into a slogan, his attitude should be one of affable determination.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

3,535. "Manometers." H. Martin. February 6th, 1923. (219,716.)

5,628. "Protective arrangements for electric distribution systems." Switchgear & Cowans, Ltd., and G. H. Neep. February 27th, 1923. (219,717.)

9,121. "Electric circuit-breakers and the like." A. Reyrolle & Co., Ltd., H. W. Clothier, and B. H. Leeson. April 3rd, 1923. (219,723.)

11,408. "Electric vacuum-tube devices and the like." E. Y. Robinson. April 27th, 1923. (219,731.)

11,715. "Switches and circuit arrangements for telephone systems employing automatic selectors." Siemens Bros. & Co., Ltd., and D. A. Christian. May 1st, 1923. (219,740.)

12,015. "Trucks for tramway vehicles." E. Y. Walsh and E. A. Walsh. May 4th, 1923. (219,752.)

12,602. "Vehicles for use on rail-traction systems." English Electric Co., Ltd., and C. E. Fairburn. May 10th, 1923. (219,762.)

14,150. "Renewable primary dry-cell batteries." W. S. Doe. May 29th, 1923. (219,769.)

15,791. "Manufacture of small electrical appliances of glass." L. Sanchez-Vello. June 23rd, 1922. (199,726.)

16,315. "Galvanic batteries." Fuller's United Electric Works, Ltd., and L. Fuller. January 22nd, 1923. (219,785.)

18,423. "Electric altar bread-baking device." J. Meany. July 17th, 1923. (219,811.)

20,965. "Thermionic devices." G. La V. Geisey and F. W. Brown. August 17th, 1923. (219,823.)

21,207. "Holders for thermionic valves." A. P. Welch. September 4th, 1923. (219,826.)

24,214. "Electric lighting systems for motor vehicles." British Thomson-Houston Co., Ltd., and L. Griffiths. September 28th, 1923. (219,835.)

24,466. "Frame aerials for wireless apparatus." W. J. Davis. October 2nd, 1923. (219,836.)

25,818. "Apparatus for exhausting electric lamp bulbs and other hollow bodies." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 27th, 1923. (206,137.)

28,389. "Adapters for electric lamp holders, wall plugs, connectors, and other terminal fittings." D. E. Barnett. November 10th, 1923. (219,854.)

28,789. "Spark plugs." R. Steinacher. November 15th, 1923. (219,856.)

28,853. "Diaphragm for electrolytic processes." P. Reinhardt et Cie. November 28th, 1922. (207,801.)

29,772. "Systems for multiplying frequency by means of electric transformers." W. Dornig. November 26th, 1923. (219,862.)

31,996. "Automatic reclosing electric circuit interrupter systems." Metropolitan-Vickers Electrical Co., Ltd. December 21st, 1922. (208,724.)

32,183. "Automatic and semi-automatic telephone exchanges." Allmanna Telefonaktiebolaget L. M. Ericsson. December 28th, 1922. (209,079.)

1924.

309. "Control systems for automatic electric sub-stations." Metropolitan-Vickers Electrical Co., Ltd. January 8th, 1923. (209,422.)

672. "Magneto-electric machines." F. Eichert. January 9th, 1924. (219,875.)

2,000. "Electric irons." A. R. Cheeseman. January 24th, 1924. (219,882.)

2,356. "Casings and supports of dynamo-electric generators, more particularly for the lighting sets of motor or other cycles." Frankonia Akt. Ges., vorm A. Frank. February 9th, 1923. (211,118.)

2,981. "Electric joints." C. J. Beaver and W. T. Glover & Co., Ltd. February 5th, 1924. (219,886.)

Standard Limits and Fits.—A Committee of the British Engineering Standards Association has had under consideration for some considerable time the question of limits and fits for cylindrical work, and a successful conclusion has been reached by the issue of Publication No. 164-1924, "British Standard Limits and Fits for Engineering." The first section includes a brief statement regarding the adoption of the hole basis as the British standard, definitions of the unilateral and bilateral systems of tolerance, and the reasons which have led the Committee to recommend the use of the unilateral system as applied to cylindrical mating surfaces in cases where it does not conflict with predominating present practice. This is followed by explanatory notes and general directions for using the tables of British standard tolerances for both unilateral and bilateral holes, for shafts and for the fits obtained by the mating of the shafts with certain of the holes. The report concludes with diagrams giving a graphical representation of the various tolerances and fits. A wall chart (Publication No. 164 B-1924), giving the tables and diagrams in inch units, with explanatory notes, has also been issued. Copies of these publications (Nos. 164-1924 and 164 B-1924) may be obtained from the B.E.S.A. Publication Department, 28, Victoria Street, S.W.1, price 1s. 2d. each, post free.

The National Institute for the Blind.—We have received this Institute's report for the year ended March 31st last containing a review of the important work accomplished during that time for the alleviation of the lot of those afflicted with blindness. A valuable feature of the Institute's work is the training of blind persons in a number of trades and professions to help them to at least reduce that dependence upon others which is one of the many hardships of the blind. Among new developments it is interesting to note that the new art of broadcasting has provided an opportunity for the talents of blind musicians and singers.